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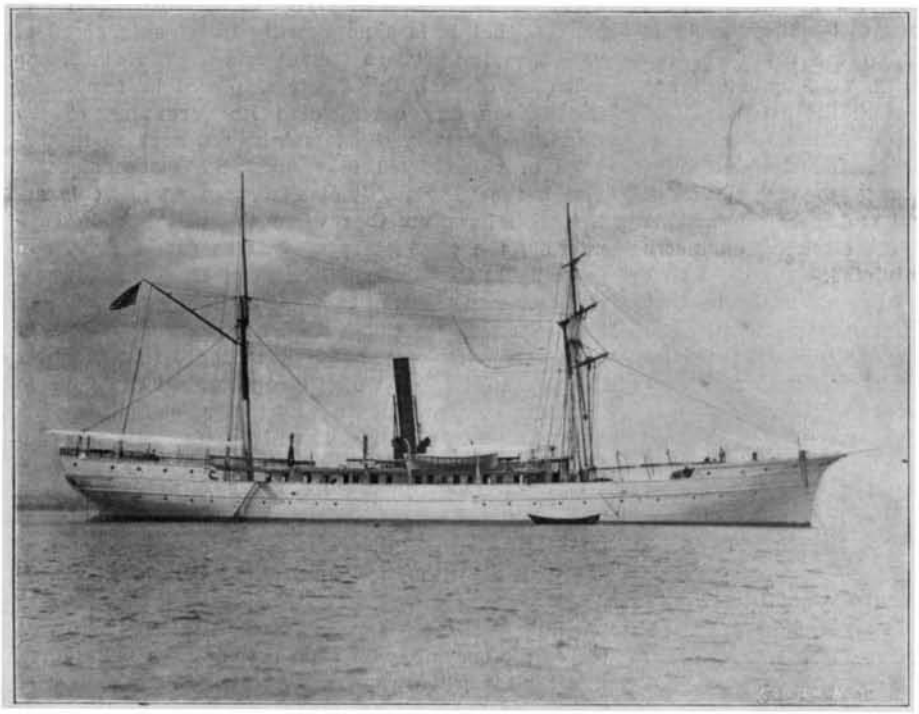
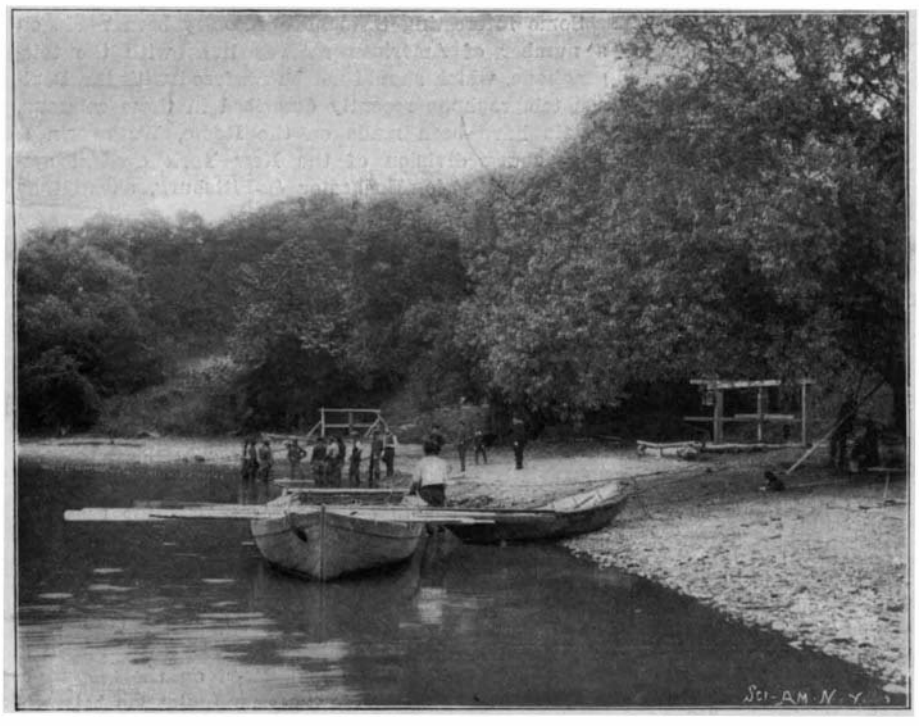


The Fish Commission Ship "Albatross."

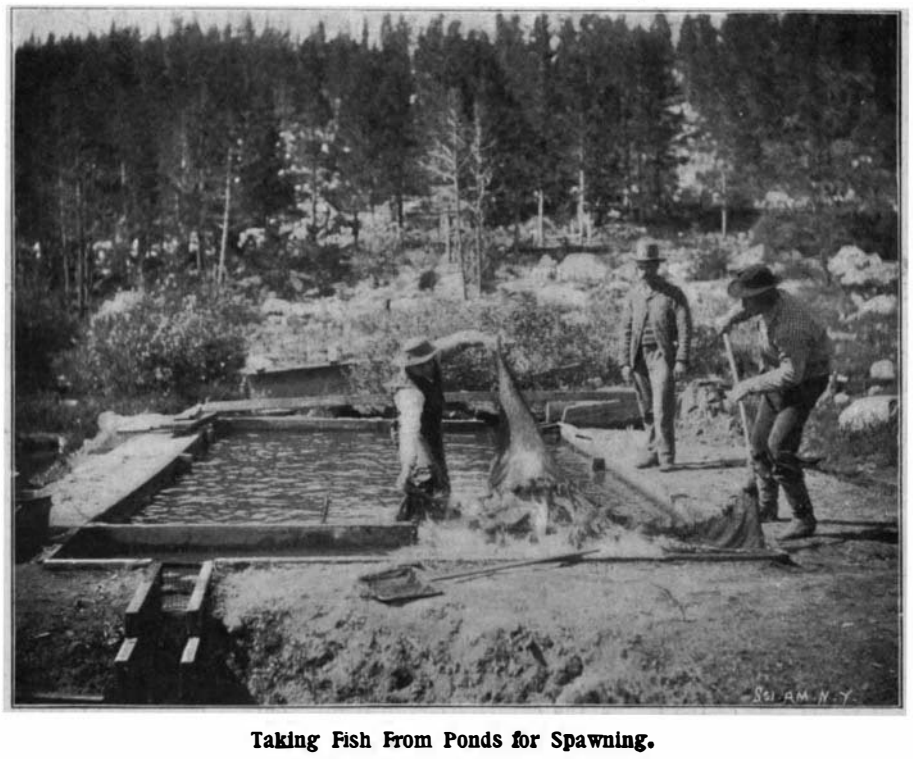
Loading Cans of Shad Fry on Launch.



Landing Shad Seine, Potomac River.

Hauling Shad Seines on the Potomac River.

Sorting and Spawning Trout, Northville, Mich.



Taking Fish From Ponds for Spawning.

THE WORK OF THE UNITED STATES COMMISSION OF FISH AND FISHERIES.—[See page 290.]

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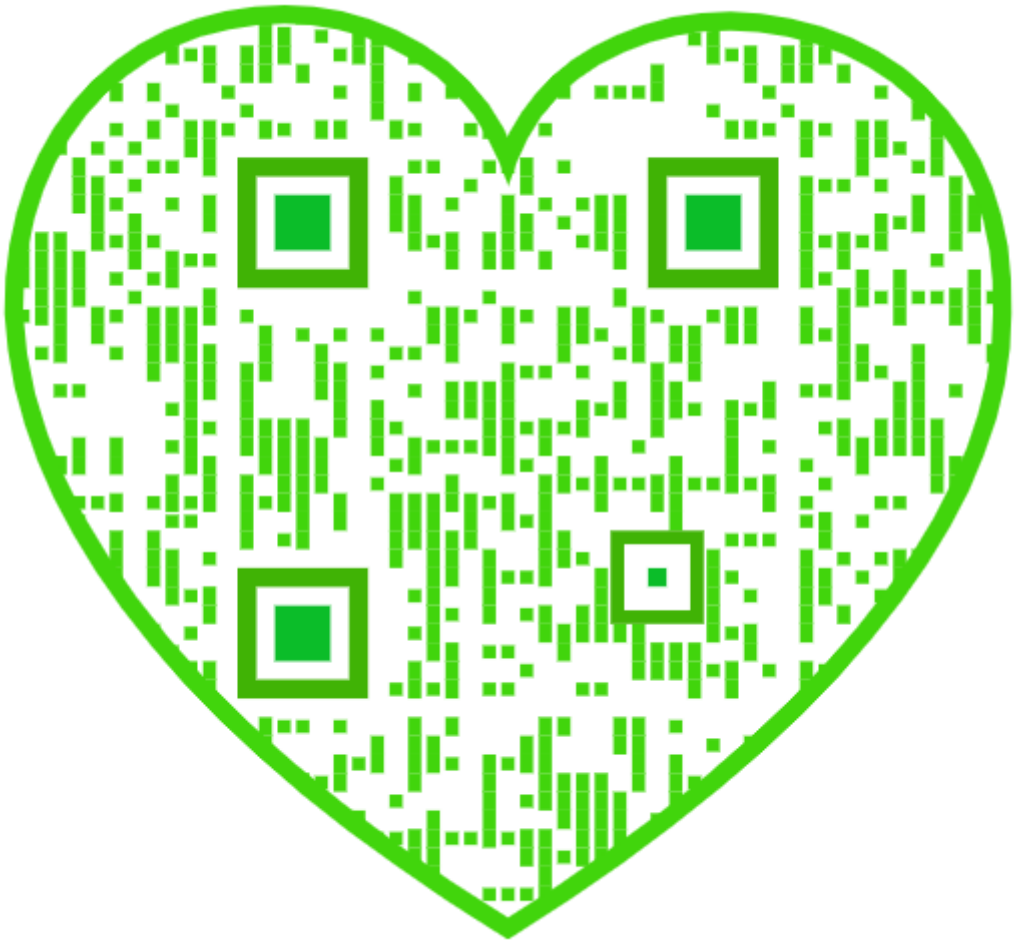

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NEW YORK, SATURDAY, OCTOBER 24, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE ECONOMY OF ELECTRIC TRACTION.

It is not often in the development of a comparatively new invention or industry, that we have such a rare opportunity to test the new against the old as has been afforded by the substitution of electric for steam traction on the Manhattan Elevated Railroad system in this city. Here was the case of a long-established railroad that had been operated for several decades under the same management upon practically the same lines, that suddenly made a complete change in the character of its motive power, the other conditions, such as track, rolling stock, character of traffic, etc., remaining precisely the same. Hence the comparison is devoid of those complications arising from incidental and outlying influences, which are too often overlooked, but nevertheless exert a powerful modifying effect upon the ultimate result. It is, indeed, impossible to lay too much stress upon the significance of the results shown in the first months of the electrical operation of this railroad; and it is conceded by electrical engineers that in the present case the relative merits, in point of convenience to the public and economy for the company, have been proved to absolute and final demonstration.

Now, let us consider the official statement of the earnings and expenses of the system for a period of three months in two successive years, namely, the quarter ending June, 1902, and the same quarter in 1903, it being borne in mind that during the first quarter the Manhattan Elevated Railroads were operated entirely by steam, and in the second quarter entirely by electricity. During the quarter ending June, 1902, the gross earnings under steam operation amounted to $2,857,250. In the same quarter in 1903, the gross earnings under electrical operation were $3,271,787, an increase of $414,537. The expenses for the quarter in 1902 were $1,401,106, and for the same quarter in 1903 they fell to $1,302,089, a decrease of $99,017. The net earnings, therefore, showed for the quarter an increase due to the introduction of electrical traction of $513,534. These are most surprising and gratifying results, better probably than even the most sanguine advocates of electric traction would have predicted; and they are particularly gratifying when we remember that both the company and the public have reaped the benefit; for while the company's earnings have been largely increased, the public are being carried at greater speeds, with less crowding, and on a more frequent service than they ever knew or dreamed of in the days of the steam locomotive. The great increase in the capacity of the road is to be attributed primarily to the greater tractive power which can be applied to trains under electric than under steam traction, particularly on a structure like the Manhattan Elevated, which has a very limited carrying capacity, and will not admit of wheel loads above a certain limit. The old steam engines, built to carry the maximum amount of load on their axles that the structure would permit, exerted a maximum drawbar pull of 7,000 pounds, and the longest trains that could be hauled at the slower speeds that prevailed under the old system, consisted of five cars. With motors carried on the axles of the cars, however, the power was raised to the equivalent of a 20,000-pound drawbar pull, or the equivalent of about three of the steam locomotives. This resulted in an acceleration of the speed of from 20 to 30 per cent. At the same time, the old vacuum brake was replaced by the Westinghouse air brake. Moreover, it became possible to run six-car instead of five-car trains, and thus it will be seen that with an increase of twenty-five per cent in train speed and twenty per cent in the size of the trains, the capacity of the road was vastly augmented. The immediate effect has been an increase in the capacity and number of the trains, a marked decrease in the crowding of the trains, and an all-around improvement in the service. As showing the distance covered by the trains, it may be mentioned that, although there is a total of only 110 miles of track, the train service has reached under electric traction an average of 165,000 car-miles per day. Now just what this means can be best understood by a comparison with one of the trunk lines, say, for instance, the New York Central between New York and Albany. Taking as a basis the Empire State Express, which is a four-car train, we find, by a little calculation, that in order to maintain a service of these trains that would make in a single day a car mileage of 165,000 miles, it would be necessary to start an Empire State Express at intervals of ten minutes, both from Albany and New York, throughout the whole twenty-four hours. Summing up the results of the change from steam to electricity, we find that it has reduced the operating expenses at the rate of about $400,000 per annum, and increased the earnings at the rate of over $2,000,000 per annum. To have done this with the added convenience to the public of higher speed and more frequent and more comfortable service, as a feat upon which the electrical engineers are to be most warmly congratulated.

Public attention will now turn naturally to that other great work of electrifying steam railroads, namely, the change of the New York Central lines, involving the whole of the suburban traffic for from twenty-five to forty miles out of New York. While it is too much to expect that on these roads, with their heavier trains and less frequent service, equally remarkable economies will be effected, we have not the slightest doubt that the advantages both to the operating companies and to the traveling public will be so great, as to bring the date of the complete electrical operation of all-steam railroads, long-haul and short-haul alike, within measurable distance.

THE STORAGE RESERVOIR AS A PREVENTIVE OF FLOODS.

Although the suggestion to use storage dams as a preventive of excessive floods has been carried to somewhat extravagant lengths of late, there is no question that there are many rivers in the United States subjected to disastrous overflow which might be kept within their bounds by this very practicable method of control. As a case in point we might mention the turbulent Passaic River, which has played such havoc upon that twice-stricken town of Passaic, N. J. Here is a case where the loss of several lives and several million dollars has twice occurred within a few months, because of the inability of the river to carry off the surplus waters of a heavy rainfall. The magnitude of the recent precipitation, when in the course of two days there was a fall of 10½ inches of water, proves that in a case like this the only possible method of control would be the temporary storage of the excess waters during the rainstorm, and their subsequent gradual release into the ordinary river channel. In commenting on the possibilities of such control, our contemporary, the Passaic Daily News, quotes from the report of C. C. Vermeule, of the New Jersey State Geological Survey. The report, which was called for by the State after the disastrous flood of last year, proposes to create storage reservoirs converting certain flats in the Passaic Valley into artificial lakes. This remedy would be a sanitary measure; would serve the purpose of draining these flats; would render heavy freshets harmless; and would have the great advantage of maintaining the normal flow of the river at four times its ordinary amount. At the same time the provision of these reservoirs would mitigate the sewage evil, keeping the river well flushed, while incidentally it would afford at Little Falls and Passaic an extra provision of over 10,000 continuous hydraulic horse power. Consequently, not only would the city be safeguarded against the recurrence of these most disastrous floods, but the very works by which this security was obtained would prove a valuable asset to the city as a source of light and power. On the face of it, the report calls for the most serious consideration on the part of the authorities, and if the proposal is carried through, its operation will be watched with close interest in other communities that are subjected to similar disastrous overflows.

THE FIRST TURBINE ATLANTIC LINER.

The steam turbine having proved highly successful in its adaptation to steam yachts and the smaller types of passenger steamships engaged in the Clyde and the English Channel traffic, it has been decided to construct an Atlantic liner equipped with this engine in place of the ordinary reciprocating engines. The Allan Steamship Line have been closely following the developments of the turbine-propelled vessels at present in operation, their behavior under all conditions of weather, their speed, economy, and steadiness in travel, and proportion of coal consumption in relation to the speed developed. They have now decided to build a ship equipped with the turbine for traffic between the Clyde and Canada. This liner when completed will be the largest and heaviest, as well as the fastest vessel in the Allan fleet.

The contract for the construction of the vessel has been placed with the shipbuilding firm of Workman & Clark, of Belfast, Ireland, and the turbines will be built by the Parsons Company, of Newcastle-on-Tyne. The vessel will be 500 feet in length over all, with a gross tonnage of 12,000 tons; a horse power of 10,000 indicated, and a contract speed of 17 knots.

It may be urged that the speed is very low in comparison with that of some of the vessels driven by reciprocating engines plying between New York and Europe; but it is a noteworthy increase in speed of vessels plying between Canada and Great Britain. As a matter of fact, this latest ship will be two knots faster than any other Allan liner running to the Dominion ports, while it marks an increase in tonnage of about 1,400 tons upon the last-constructed vessel, the "Tunisian," of the Allan fleet. It is anticipated, however, that when the vessel is in commission, the contract speed will be exceeded. There is no doubt that had the British or the Canadian government seen the way to grant a subsidy to the Allan line in regard to this vessel, a greater speed would have been arranged; but it is conceded that 17 knots is the fastest speed which the promoters can hope to maintain at a profit in a vessel engaged in this class of traffic. At all events, it will satisfactorily meet all the requirements of the St. Lawrence trade.

To the Allan line will consequently pertain the honor of having introduced the turbine in a transatlantic liner, and the results of the experiment will be followed with keen interest by the various shipping companies engaged in ocean traffic. It also partially realizes the ambition of Parsons, the inventor of the turbine, who from the first has maintained that his invention was the most satisfactory system of propulsion for deep sea trade.

THE TELEPHONE AND THE RAILWAY.

Some interesting tests have recently been made on a number of American railway lines with the telegraphone, which should not be confused with the Poulsen telegraphone recently described in these columns. Trials have been made on the Rome, Watertown & Ogdensburg division of the New York Central system, the Buffalo, Rochester & Pittsburg, as well as the Atchison, Topeka & Santa Fé.

One object of the telegraphone is, in case a train is halted between stations, to enable the trainmen to communicate at once by telephone with the dispatcher at either end of the line, without interrupting the telegraphic business on the wire so utilized. One of its functions also is to establish communication at will between a station where there is no telegraph operator or a siding with the dispatching officers of the division. In order to accomplish these results, a telegraph wire, which may be the wire used by the dispatcher or any commercial wire, is equipped especially for the purpose. In equipping a train, a special telephone is installed in one of the cars. This telephone is provided with a reel, an insulated wire, and a portable extension rod to which connection from the train telephone is made. The extension rod is provided with a file-surfaced clamp, which is placed on the telegraph wire, thus establishing electric communication between the train instrument and the wire, without cutting into the line.

If a train, equipped with the telephone appliances, is halted between two stations, and it is desired to get into immediate communication with the dispatcher, by means of a special magnet, a direct pulsating signal is made, which gives the telephone call to all of the Morse instruments on the line on the side of the temporary connection with which it is desired to communicate, neglecting the Morse instruments on the other side of the temporary connection. This call is a signal for the dispatcher to go to the telephone installed in his office. Having done so, he is in direct communication with the halted train by telephone. While communication with the train is maintained, as has been said, the business of the Morse circuit on the same wire is not interrupted, nor is the telephone communication interrupted by the operation of the Morse circuit instruments. If it is desired to communicate with the dispatcher at the other end of the division, a plug is placed in another "jack" in the train instrument, and the initial signals affect only the relays on that side of the temporary connection. Wherever instruments are placed in stations, and when it is desired to communicate with the dispatcher from a station, the operator at the station calls the dispatcher to the telephone, by signal over the wire. When a track instrument is placed at a siding, all that is necessary to summon the dispatcher to the telephone is to give the emergency ring on the telephone.

The method of equipping a wire for telephone pur-

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poses is simple, but interesting. In stations where Morse instruments are "cut in" to the circuit, these instruments are bridged with dead non-inductive resistance. The relays of the Morse instruments are wound for 100 or 150 ohms inductive resistance. The high resistance of the shunt is, on the contrary, a non-conductive. It is so constructed as to eliminate the factor of impedance when the high-frequency telephone current is superposed on the line. Thus the high shunt resistance prevents the passage of the Morse current, but in accordance with the well-known law, it will offer a free path for the talking waves. The shunt resistance being non-inductive, does not impede or interrrupt the high-frequency telephonic current. The initial call is made by means of a direct, slowly-pulsating signal by a special magnet with two segments on its armature, one only of which is alive, thus giving direct, pulsating waves. If by means of the plug and jacks in the train instruments, this direct, pulsating current is given one polarity, the pulsating current will affect the Morse relays in the circuit to its polarity. On the side of the temporary connection, where the line is in direct polarity with the superposed pulsating current from the special magneto generator, the latter will strengthen the battery on the part of the line, and will not annunciate the emergency signal on that part of the line. On the other side of the temporary connection, over which it is desired to communicate, however, the pulsating magneto current is in opposition to the force of the line battery on that part of the circuit which is a reverse polarity. As a result, all relays on that part of the line which are in reverse polarity are caused to give the brief pulsating call. If it be desired to give the signal on the opposite side of the temporary connection, the plug is inserted in the other jack, reversing the polarity of the magnet. It will be understood that the magnet circuit is normally open, except when the brief emergency signal is being given. A condenser connected into the secondary of the telephone prevents the Morse current from grounding, while at the same time permitting the passage of the talking waves of the telephone current.

One of the most interesting trials of the telegraphone recently occurred on the line of the Rome, Watertown & Ogdensburg Railroad, under the supervision of Mr. John Dennis, of Rochester, N. Y., the inventor. A locomotive and tool car were dispatched from Rochester toward Oswego under the orders of the dispatcher at Oswego. The trip was made over a busy single-track railway, but it was understood that a stop could be made between stations at discretion. A heavy rain was falling, electrical conditions thus lending themselves to the breakdown test which had been determined upon. Between Windsor Beach and Sea Breeze stations, the wrecking outfit came to a halt on the main line. One of the crew attached the wire from the reel of the train instrument to an extension pole, with a clamp on its extremity, and hooked it over a commercial wire which was crowded with messages. A call was made through the relays on the line on the side toward Oswego, and within thirty seconds from the time the special had halted, communication was established with the train dispatcher at Oswego, seventy miles distant, and the train was placed under his orders. After calling Trainmaster Halleran, in his office at Oswego, to the telephone, and exchanging condolences on the weather, by simply changing the jack in the caboose instrument the agent at the Rochester office was called in turn in a similar manner. The Rochester operator jacked the telegraphone in with the Rochester Telephone Company's exchange, at Rochester, and a conversation was held from the wrecking outfit, otherwise isolated between stations, with the superintendent of that company. Then Mr. Dennis's home telephone was called, and he talked with his family. The Oswego dispatcher, who had been constantly in touch with the isolated train, was called, and orders for the movement of the special were taken by the trainmen. One of the men removed the pole, the wire was reeled in, and the special started on its return trip.

THE BRITISH QUEST FOR AN EIGHTEENPENNY SAFETY LAMP.

In no way discouraged by their previous failures to find a table-lamp which may reasonably be regarded as "safe," and which can be retailed at a fair profit at 1s. 6d., the promoters of the Grocers' Exhibition have again this year invited inventors and manufacturers to send in designs embodying the conditions laid down, and, as a further stimulus to competition, have increased the monetary value of the prize from £50 to £120. This sum itself is well worth having, but Mr. A. J. Giles, the secretary to the committee which has the matter in hand, stoutly maintains that, when put to practical use, the successful design would probably be worth twenty times the amount of the prize to the inventor. In the conditions laid down the committee stipulated that the design, to be successful, must be satisfactory from a mechanical, a scientific, and a commercial point of view—that is to say, (*a*) the lamp must be made of thoroughly sound and durable materials, and be of reliable workmanship; (*b*) it must be adapted to burn any brand of petroleum; and (*c*) it must be possible for oilmen or grocers who possess no special acquaintance with lamp-construction to handle and sell it at a profit. Whether all, or indeed any, of these conditions are to be found in the designs sent in this year will not be known until the judges have made their report (which may not be for some weeks yet), but so far as a superficial examination of the selected patterns and a demonstration of their capabilities, carried out in the presence of members of the trade press on September 24, enable one to form an opinion, it seems quite within the range of possibility that a solution of the problem has been found.

For obvious reasons, continues the Ironmonger, from which paper these remarks are republished, no detailed inspection of the internal construction of the competitive designs was permitted at the demonstration, nor will the names of the judges be divulged, for the present at all events. We were, however, assured by the secretary that the committee are being advised by gentlemen who are experts in lamp-construction, and upon whose decision the competitors and the public alike may place implicit confidence.

The preliminary tests on September 24 were open to the public, and were carried out in a roped-off portion of the Minor Hall at Islington, the lamps (of which some eighty-four had been sent in, as against fifty-three last year) being arranged on trestles placed against the wall. As a precaution against fire, a heap of wet sand in charge of some workmen was provided, and one of the firemen attached to the place was also in attendance. About half a dozen of the more promising lamps having been lighted and turned up fully, the attendants proceeded to tip them upside down, the operation almost invariably bringing the various extinguishing devices into play and promptly putting out the light. In several instances, however, the oil followed the example of the flame, and also "went out" of the container in rather an unpleasant and disconcerting fashion. Indeed, one fantastically devised light-giver, formed with an inner oil-container swinging upon the outer shell, gimbal fashion, completely emptied itself of oil upon being inverted. Among the little knot of privileged spectators who were admitted inside the ropes were Mr. Alfred Spencer, of the L. C. C. Public Control Department, and Dr. Paul Dvorkovitch, of the Petroleum Institute, both of whom, although for different reasons, are deeply interested in the subject of safety-lamp construction.

The bulk of the lamps on view were of British make, but there were a few designs from Germany, Austria, and France, and one or two from British colonies. The patterns adhered in the main to the familiar table-lamp style, viz., square or circular base, with vase-shaped container, and the orthodox basket, gallery, cone, and winder. Several radical, and even daring departures from the conventional outline were, however, to be seen. One of these monstrosities was shaped something like a "duck" or "torch" lamp, the only point which redeemed its unspeakable ugliness being the impossibility of the flame ever heating the container or of raising the temperature of the oil to flashing-point. Another freak was so arranged that, when it stood on a table by itself, an extinguishing-cap was "on," and only by holding the base firmly down by both hands could the wick be lighted and kept alight. Such a lamp might be suitable as a punishment device for convict prisons, but it would hardly be the sort of thing to introduce into happy British homes. Another funny pattern embodied a container with a water-jacket, the idea being to keep the oil cool while the lamp was alight and to "douse the glim" in the event of the structure being upset. With this device the inventor had considerately sent two small enameled mugs—one, as he was good enough to explain, being for pouring in the oil and the other for pouring in the water. Most of the lamps were fitted with flat-wick burners, but a few had a round wick and flame-spreader.

Metal predominated in the construction, some of the cast-iron bases being very poor specimens of the founders' art, while the attempts at decoration were equally unsatisfactory. Many of the bases, moreover, were too small for security, a point which lamp-designers frequently overlook. Glass containers were but sparingly adopted, and, so far as one could see, even the few on show were not sufficiently stout to render them reasonably safe against breakage if overturned or dropped onto the ground.

All the designs appeared to be provided with chimneys, and nothing of a freak character had been attempted in this direction, the committee having been emphatic on the point that the lamp galleries and burners should follow the accepted shapes, so as to put no difficulties in the way of the purchasers of the approved pattern obtaining refills of wick and new glasses.

After the conclusion of the testing the judges and committee adjourned to the restaurant in the hall for lunch.

Replying to the toast of his health, Mr. A. J. Giles, who is the organizer of the lamp competition, mentioned that his committee, undeterred by previous failures, were determined to persevere in the attempt to find a lamp answering their requirements. The fact that from 300 to 500 fires were caused in the metropolis each year, in addition to much loss of life, from the use of insecure lamps, was, he contended, ample justification for the efforts they were making. The committee had been greatly encouraged by the expert assistance and advice which had been placed at their disposal, and they were confident that ere long success would be achieved.

NEW GERMAN RED PHOSPHORUS MATCH.

By a law of May 10, 1903, Germany forbade the use of white phosphorus in the making of matches. A new material, made of non-poisonous red phosphorus and potassium chlorate, has been bought by the government and is to be substituted in its works for the deleterious and oftentimes more dangerous white phosphorus. A commission of experts appointed by the government to consider the matter of allowing or forbidding the use of white phosphorus and of buying the right to manufacture the new material defends itself against the claim that the new material, which lights at a point about 100 deg. (160 to 180 deg. Cel.) Réaumur, is of little more value than the white phosphorus match-making material, which lights at 50 to 80 deg. Cel. In spite of its high igniting point, the new material may be lighted by scratching on almost any material—sandpaper, bricks, boards, soles of shoes, rough clothing, etc. Great gain attaches to the fact that it does not ignite easily, hence removing or minimizing the danger from fire. How important this is appears when one is reminded of fires caused by the ignition of white phosphorus matches by the sun's rays. In regard to danger to employes, the commission says explosions are practically impossible with the new material.

Then, again, the fact that the new material contains only 15 per cent of lead, while all others contain from 18 to 45 per cent, is in its favor. Matches made of the new material in 1898, when the government first bought the rights thereto, were found to be as good in 1903 as they were when made. The prices of production are interesting. The new kind cost 6.3 marks ($1.50) per 100,000 for the cheapest, and the dearest, 8.10 marks ($1.93). The prices of the others run between 60.50 and 68.20 marks ($14.40 and $16.23).

THE CURRENT SUPPLEMENT.

The rapid increase in the number of agricultural colleges throughout the country is partly responsible for the remarkable improvement which has been noted in the farming methods of those States which are fortunate enough to possess such institutions. Day Allen Willey, in the current SUPPLEMENT, No. 1451, discusses the Agricultural College of the Ohio State University, a typical institution of its kind, and shows just how the instruction fits the student for scientific farming. Mr. Charles J. Sullivan shows how it is possible to produce a battery of sufficient power to perform the many practical experiments requiring a voltage of at least fifty. His outfit requires the care of only five gravity cells. Prof. Robert H. Thurston presents an instructive paper entitled "Functions of Technical Science in Education for Business and the Professions." Of interest to automobilists are the articles on the Ossant muffler and the Lohner-Porsche electric automobile. Mr. Albert Ladd Colby in a valuable article presents a *resumé* of the properties and applications of nickel steel. The usual Selected Formulæ, Trade Notes and Recipes and Consular Notes are also published.

ALUMINIUM IN FLOWERING PLANTS.

Hitherto aluminium has not been found in phanerogamic plants, or at most only in minute traces, although cryptogams appear to use it as a food material. Mr. H. G. Smith, of Sydney, however, has recently found it in one tree belonging to the Proteaceæ, viz., *Orites excelsa*, R.Br., in even greater abundance than it is found in any of the cryptogams. In a paper read before the meeting of the Royal Society of New South Wales, Mr. Smith showed that this tree uses aluminium almost to the exclusion of other mineral elements, and that the aluminium is deposited in cavities and natural fissures as a basic succinate.

SUN SPOTS PHOTOGRAPHED.

Two photographs of spots on the sun have been taken at the Naval Observatory. The photographs show a group of spots, the largest observable for many years, capable of being seen with the naked eye protected by smoked glass.

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A FLOODED TRACK.

The picture presented herewith tells its own story of the trials of the railroad engineer in the middle West. The illustration shows a train hauled by two locomotives across the Loosahatchie River bottom, south of Woodstock, Tenn., last March. The system of levees along the Mississippi is a source of endless trouble during the spring freshets. Time was when breaks would occur in the lowland and a comparatively small area would be flooded; but with the present system of embankments the river rises higher and higher. The result is that considerably more damage is done than was formerly the case. Even when the levees hold, the small tributary rivers become so flooded that the backwater does much damage. Our picture shows a condition of affairs which was thus caused. In order to retain the tracks in place, the plan is adopted of spreading over the ground to be occupied by the embankments, brush, old timbers, and slabs of logs. These form a kind of mattress which clings together and thus holds the embankment in place until the timber has decomposed and the bank has found a permanent bed.

TRAIN CROSSING THE LOOSAHATCHIE RIVER BOTTOM SOUTH OF WOODSTOCK, TENN.

CONSTRUCTION OF THE RAILROAD ACROSS SALT LAKE.

The Southern Pacific Railway Company is constructing a new line through a portion of Utah which involves some engineering work of unusually difficult character owing to the obstacles which must be overcome. The improvement is known as the "Lucin cutoff" and is being built to avoid the present circuitous route around Great Salt Lake. For several years past the company has been considering a new line which would shorten the distance between the Mississippi River and the Pacific coast and at the same time avoid some of the heavy grades which are encountered in this section of the West. The present line extends from Ogden to Lucin by way of Belfour, Kolmar, and Promontory, a distance of about 150 miles. On the route is what is known as Promontory Hill, which is one of the steepest ascents of the entire system and which trains have been unable to ascend at the speed of over 12 miles an hour.

The surveys made by the railroad engineers provided for a line about 105 miles in length with a maximum grade of not over 21 feet in a mile, but they found it was necessary to cross the lake and the plans included one of the longest trestling systems in the world, if not the longest, for the total distance across the lake is about 28 miles. The lake is somewhat curious in shape at the point where the railroad is intended to cross it. The northeastern portion is formed into a bay by a promontory which projects southward. In making surveys the engineers took advantage of this promontory and included it on the route so that the lake crossing really consists of two sections. From the eastern end of the cutoff at Ogden to the shore of the lake the distance is 13 miles. In building this portion little difficulty was experienced, as the country is comparatively level, with the exception of what is termed Little Mountain, through which a cut was made. As is well known, Great Salt Lake is one of the shallowest bodies of water in the world considering its dimensions, and in some portions a man may wade nearly a mile from shore without being completely submerged. The contractors decided to take advantage of this condition by making a solid roadbed as far as possible out in the water and material from the cut at Little Mountain was hauled out on a temporary track and used for filling. It was discovered that in some places the bottom was composed of crusted salt and sand extending to a considerable depth. In other places the formation was so loose that the longest piles driven into it would not become firmly imbedded. These were supposed to be depressions in the formation which could be readily filled. To form a permanent roadbed near shore a somewhat novel railway was laid, consisting of planks upon which were placed sandbags to hold them in position. On these, ties were placed to which the rails were spiked. As fast as this temporary track was laid, the cars would be run out and dumped over the side. In spite of the large quantity of material used on the section of the road constructed in the shallow water it was noticed that here and there depressions were continually occurring, showing that the foundation was still sinking. Only construction trains were used on the completed portion drawn by light locomotives but at frequent intervals it has been necessary to build up the roadbed where the sinking has been extensive and relay the track. Although the work upon the shore ends of the lake crossing began over a year ago some portions are still settling.

By far the most serious difficulty, however, has been encountered in the deeper part of the lake near the promontory referred to. Here the water ranges in depth from 20 to 30 feet, and it was determined to lay the track upon trestle work. For this purpose piles of the largest size were secured to be driven in for posts to support the framework, some of the piles being over 40 feet in length. Pile drivers built on rafts were towed to several points along the line and the work of driving the foundation began. In some places the bottom was so hard that but a few inches could be driven at a time. This led the engineers to believe that they had a substantial foundation for the structure. After being driven a few feet, however, it was discovered that most of the piles had apparently pierced what seemed to be a mere crust and in some cases a few blows of the driver forced them out of sight. An examination was made at several points, which disclosed the fact that a bed of soft material underlay the bottom, being covered by the crust referred to which seemed to be composed principally of salt and sand. Where the piles held and the trestle was completed several mishaps occurred which showed that it would not be practicable to operate trains over the structure unless it rested upon something more substantial than the natural base. In one instance an engine and two gravel cars, which were moved over the trestle, so weakened the work that the train crew had just time to detach the locomotive before the piling collapsed and fell into the water, carrying the cars with it.

Framework of Trestles Which Collapsed.

Construction in Shallow Water, Showing Sandbags and Planking Used to Sustain the Temporary Track. Sections of the Permanent Track Have Been Depressed by the Settling of the Roadbed.

Acting on the theory that this section of the line could be filled in with rock it was decided to form what might be called an enormous jetty connecting the rock work at each end and terminating at the promontory; but in spite of the fact that several thousand trainloads of material have been dumped along the right of way, most of it seems to be swallowed up in the mysterious depression. The engineers have finally determined upon another plan which they think will be more successful. Cradles of heavy timber are being constructed which are towed to deep water, then filled with stone and sunk, thus forming cribwork which is believed will support the superstructure without difficulty. This plan, however, has been but recently carried into execution and its success as yet is a problem. The magnitude of the task can be appreciated when it is stated that the deep-water sections, where the principal trouble is being encountered, comprise nearly 10 miles in all. In this distance two very large depressions have been encountered which the engineers term quagmires. In one of these over 2,500 tons of rock were emptied daily for over a month, but the soundings indicated that the material sank about as fast as it was thrown in.

A number of explanations have been advanced for the remarkable condition which prevails. One of the mysteries of the Great Salt Lake is that it apparently has no outlet. Several large streams empty into it, however, and scientists have had an idea that the surplus water not evaporated was carried out by underground channels. Several of the railroad engineers who have examined the deposits brought to the surface from the so-called quagmires, are inclined to believe that at this point a very large depression or gorge originally existed which has been by degrees filling up with silt and other loose material carried down by the currents of rivers entering the lake. There is no doubt, however, that quicksand exists in very large quantities. The original idea was to construct the roadbed through the shallow parts of the lake to a height of 15 feet above the water with a breadth of 24 feet at the top, but the settling has caused the alignment to be lowered considerably, and, as already stated, here and there it is still necessary to fill in portions which have sunk so far as to endanger train service.

When the work of constructing the line across the lake was begun, operations were commenced on the west side as well as the east, but on this end similar conditions were encountered, the west section of the road being constructed to a point about four miles from shore. The rest of the cutoff between Lucin and Ogden is completed and ready for operation, the only gap being the 10 miles referred to. The construction work in the lake itself is estimated to have cost already nearly $5,000,000, and it is not expected to complete the unfinished section before another year at least, for the crib system which is now being tried is as yet an experiment.

A truck built by the French Northern Railway has the capacity of 50 metric tons. and is the first ever built in France with such dimensions. Fifty similar trucks have been ordered by the Carmaux Coal Mines from the Douai Foundries. It is all hammered steel plate, and is of the type invented by Mr. Fox, improved and simplified by M. P. Arbel, who is proprietor of all rights in France and Russia.

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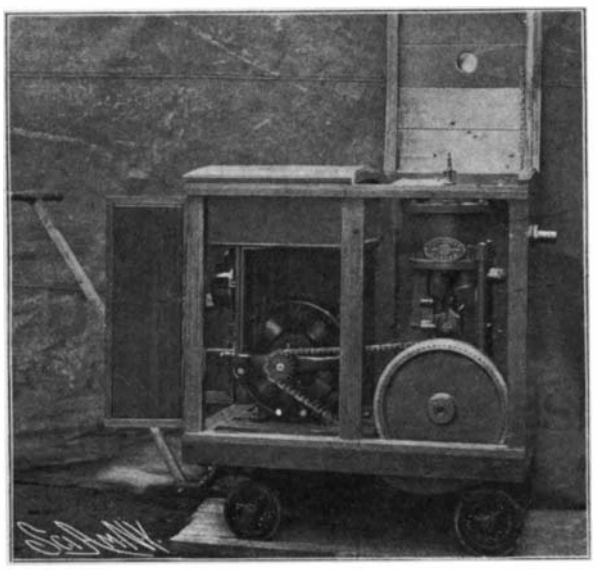
SANITARY HOUSE CLEANING.

BY DAY ALLEN WILLEY.

Several years ago the idea of using what might be called an air blast in cleaning fabrics suggested itself to a number of the railroad companies in this country, and since that time the seats and curtains, as well as the ceilings and walls of passenger coaches, in several systems have been freed from dust by the application of air through hose. The air has been compressed to various densities, the usual plan being to connect the tubing with apparatus attached to a yard locomotive, thus providing a portable compressor which could be placed wherever convenient. The jet from the hose pipe was directed against the surface to be cleaned. The plan was considered by no means perfect, as no means was provided for collecting the dirt, but most of the railroad companies which have employed it have preferred it to the broom method.

The idea, however, has originated a more elaborate system which has been tried in several cities with much success. The apparatus is constructed in a variety of forms, so that every kind of an object covered with fabric can be freed from the dirt which may settle into the covering. Even billiard tables, heavy carpets, and rugs are renovated, as well as upholstery, pillows, and bolsters. The air is supplied by compressors operated either by steam engine or electric motor, the latter usually being preferable. The compressors are constructed in various sizes, according to the service to be performed, ranging from 50 cubic feet of free air per minute upward. As they are intended for installation in hotels, apartment houses and other large buildings where the facilities for repairs are not at hand, they are especially designed for durability and the working parts are inclosed to exclude all dust and grit, while the lubrication is automatic. This is one of the interesting features of the compressor, as no sight-feed lubricator is required. The piston rod passes through a specially constructed metallic packing box, which is self-adjusting. It is provided with an improved form of packing rings, which are carefully fitted in place, both in the piston and against the surface of the cylinder, so as to form a perfect sliding joint. The extended end of the crank shaft is provided with a gear which meshes with a pinion arranged on the armature shaft immediately above. The gear chamber and the crank chamber are connected in such a way that the gear as well as the pinion are operated in a bath of oil, which oil is also supplied automatically to the bearings at the pinion end of the motor. The gear and pinion are of the helical herring-bone type, thereby reducing the noise of operation.



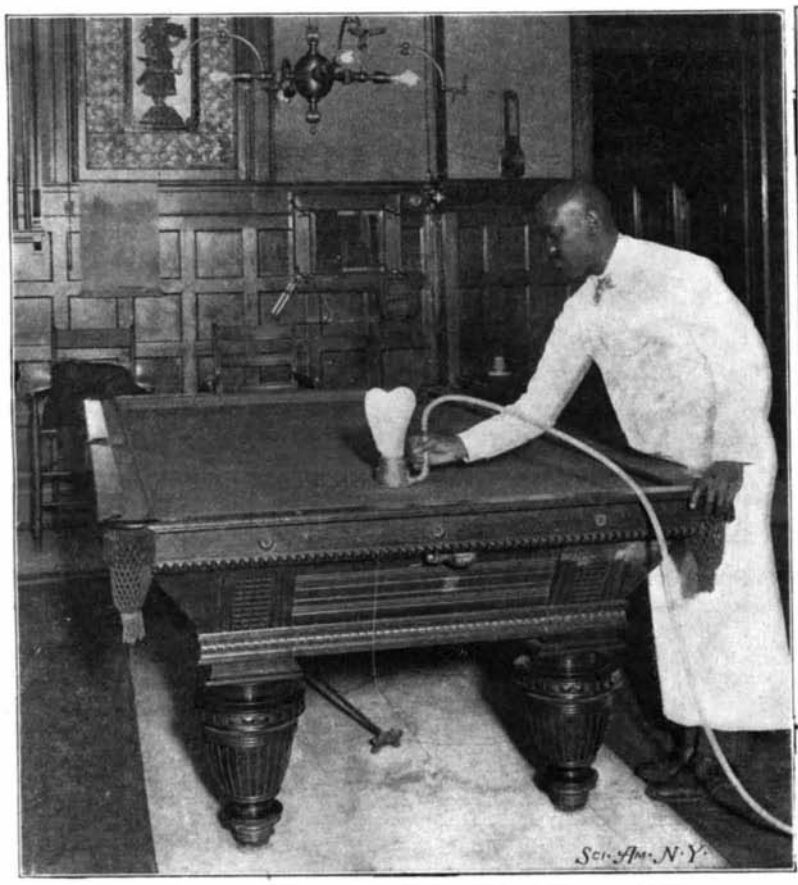
A Portable Electrically-Driven Suction Pump for House Cleaning Used in England.

If the compressor is operated by electricity the motor is usually direct-connected, taking the current from an isolated plant, or the generating set, which may be installed in the building. The motor is of the series-wound type, with formed coils of the latest pattern, and so constructed that the compressor can be started without using resistance on the motor circuit, closing the circuit in the same manner as with a knife-switch. This avoids considerable wear and tear.

As already stated, some of the compressor plants used for supplying air for cleaning large buildings are stationary. They are generally located in the basement, for convenience.

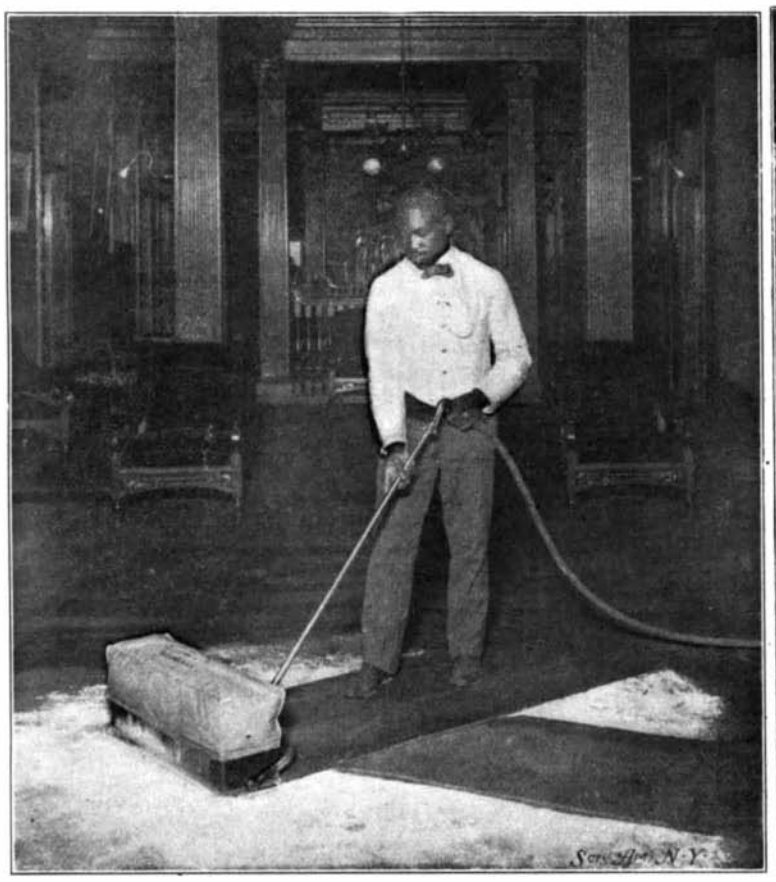
From the air reservoir extend standpipes, as they might be termed, to each floor of the building. Usually they are laid along on the inside of the elevator well or air shaft. At each floor a valve is inserted in the pipe connected with a nozzle to which a hose length can be fastened like an ordinary water pipe. To supply air to the various floors it is, of course, only necessary to start the compressor and allow the air to escape through the various valves into the hose lines. These are fastened to the apparatus to be used for floor, furniture, or tapestry cleaning, and the operation can be performed as often as desired. As is well known, hotel rooms are great collectors of dust, since the doors and windows are opened so frequently and the various apartments are in such continual use. In a well-managed hotel the floor coverings of the halls, dining room and parlors are usually swept or "run over" with the carpet cleaner at least once a day, while the bedrooms are cleaned several times a week, depending upon the extent to which they are used. Consequently the compressor plant is apt to be almost in daily use in a building of this kind.

For the cleaning of smaller buildings, such as dwellings and offices where the installation of a plant would be too expensive, a portable system is employed. A compressor of suitable size, operated by a gasoline engine, is mounted upon a truck especially built for the purpose and hauled from house to house. Hose lines are attached to the air reservoir and extended into the building as pipe is laid in extinguishing fires, and in this way the house cleaning can be performed as often as desired without removing the furniture or even taking up the carpets if it is not desirable. It is interesting to note that the



Cleaning the Chalk from a Pool Table with the Hand Machine.

Cleaning Upholstery with the Hand Machine.



Testing a Renovator by Removing Flour from a Carpet. The Dark Strips Show the Portions Which Have Been Cleaned by the Machine.

Removing Dust from Curtains.

SANITARY HOUSE CLEANING.

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automobile has been brought into use in this service, the motor which operates the air plant being also used to propel the machine when under way. Such is the capacity of a portable plant that three men can clean every portion of an ordinary ten-room house in a day of ten hours.

The types of apparatus for applying the air to the material vary, of course, according to the work to be performed. In the Nation-Christensen system, which has been installed in a number of large hotels and buildings, the carpet renovators are of various sizes, ranging from 12 to 36 inches in width. They consist of a steel framework which lies flat on the surface of the fabric. This is termed a hood, and contains an expanded nozzle connecting with the hose. In the bottom of the hood is a slot about 1-100 inch in width, through which the air passes in what might be termed a sheet. It is forced into the fabric at various pressures, according to the thickness of the latter and the amount of dirt which has accumulated. The usual pressure varies from 60 to 70 pounds to the square inch. This is sufficient to blow the dirt out of and from under the covering. It passes upward through two other slots into the hood, as it cannot escape outside of the machine on account of the weight on the surface. It is prevented from escaping into the air by a cloth bag which collects it but is loose enough to allow the air to pass through. The dirt settles into a pan especially designed to collect it. When filled, this can be readily removed by taking off the bag and emptied. To the renovator is attached a handle for moving it over the floor. The handle also acts as a conduit for the compressed air, the supply of which is regulated by an ordinary valve. The apparatus is usually pushed over the carpet and does its work so thoroughly that it will remove any kind of substance which can be driven out by air pressure. In several instances, flour was thrown upon a rug and trod in with the feet. When the renovator was applied it apparently collected every particle of the flour, none escaping into the air.

In treating lambrequins and other kinds of upholstery the hose is connected with a jointed steel tube long enough to extend to the upper portion of the apartment. The ordinary air blast is directed against the draperies and the dirt allowed to settle upon the floor and furniture. Obviously the draperies and upper portions of an apartment are the first cleaned, then the furniture and floor covering. For removing the dust from upholstered chairs, sofas, and other kinds of furniture, what might be called a hand renovator is employed. It is constructed on the same principle as the larger type with the slots for applying the air pressure and collecting the dust, and is pushed over the surface by hand. If the chair, for example, is stuffed with cotton or some other material more power is employed to force the air through this material as well. As already stated, even billiard table coverings are thoroughly cleaned of the chalk and dirt in the same way. In freeing such articles as pillows and mattresses a simple pneumatic needle is used, the air being injected with sufficient force to circulate among the feathers, straw or other stuffing and expel the dust which may have collected.

In England a vacuum-cleaner is used which depends upon a somewhat different principle. This apparatus consists essentially of a bronze suction pump driven by an electric motor. The suction pipe is connected by flexible tubing with a metal cone, which is provided with short rubber tubes disposed very much as are the bristles of a brush. Between this air brush and the pump is a hermetically sealed box which acts as a condenser of the dust gathered up. The air which is drawn in is discharged against a baffle plate so that the larger particles of dust are precipitated. The remaining portions are filtered by passing through filtering material, the clean air being then discharged into the atmosphere. The dust collected in the box can be removed by opening a valve in the bottom of the box. The apparatus which we have described is used in many English hotels and also on the steamships of the Cunard line.

Finish of the Endurance Test.

By the arrival at Pittsburg, Pa., on October 16, of five more machines from Cleveland, the total of survivors in the endurance run from New York to Pittsburg is increased to twenty-five. The contest was to have closed at midnight, but the extraordinary severity of the test warranted the recognition of the finish of the newcomers.

The examination of the surviving machines began October 16, and will be continued for several days, during which time the cars will remain officially "sealed" in the garage. Considering the ordeal through which they have gone, all the machines are in surprisingly good condition. Bent axles and broken springs seem to have been the main troubles to the running gears, while engines have been remarkably free from mishap. The Contest Committee made a hasty examination of the observers' reports October 16. They found that nine cars had reached all the night controls on time, or within a few minutes after closing time.

The scores indicate that the best record had been made by George Saules (two-cylinder Toledo), with a loss of only thirteen points from a total of 300.

WORK OF THE FISHERIES COMMISSION.

BY FREDERICK MOORE.

Of recent years the annual catch of salmon in the Pacific States and Alaska (which latter supplies half the pack of the world) has been over 100,000,000 pounds. In 1899 the quantity of salmon packed was 2,450,000 cases of 48-pound cans. The weight of the fish represented by this pack, together with the large quantities sold fresh, salted, and smoked, was about 175,000,000 pounds, in market value, $9,000,000.

According to its species and size each salmon lays from a few hundred to thousands of eggs at each spawning. Although the lays are so multitudinous the time required for the hatch and development of a fish is, according to the temperature of the water in which he is, and his variety, from three to five years; the eggs are often largely destroyed; some are diseased and never hatch; some of the fish are taken off by disease, and many become the food of other fish. When in the rivers they are comparatively safe from enemies, but those in Alaskan waters are destroyed even there by otters, ospreys, and fishers, and are terribly slaughtered at the mouths of the rivers, when entering and leaving them, by seals and sea-lions. The enormous catch, therefore, were it not for the government propagation of the fish and the restocking of the rivers, would have by now exterminated salmon, or exhausted them for all commercial purposes, at least, in western waters. Since the work of propagating the fish began in 1873 on the McCloud River, it has grown to large proportions and engages the attention of all the coast States as well as the general government, and is now more extensive than ever before.

When salmon return from the sea each year to spawn they crowd up the rivers most persistently, and have been seen so far up the rivulets that form the head waters of the Sacramento that their bodies were exposed to the air. No matter how far the headwaters are from the ocean they will press forward until stopped by impassable obstructions or water too shallow for them to swim in. As they ascend the rivers they are caught at the government stations in gill nets, fyke nets, pounds, weirs, seines, wheels, and other devices. A species called the chinook is the principal salmon artificially propagated, and while the propagation at other stations throughout the country is about the same, the work on that specimen at the hatcheries on the McCloud River and Battle Creek (tributaries to the Sacramento) are taken for example. In 1899 the number of eggs of this variety alone collected by the commission was 48,043,000, of which about 43,775,000 were successfully hatched and planted. At these two stations the ascent of the fish is stopped by heavy wooden racks or barricades, below which their capture is effected by various means. After they are secured they are, for convenience in handling, placed in pens or live-boxes, the ripe or nearly ripe males and females being kept separate. When the eggs are taken in large quantities separate compartments are maintained for the ripe males, ripe females, nearly ripe females, and males partially spent that it may be necessary to use again.

The fish are usually stripped every day, as the eggs of the females confined in the pens are likely to be injured within the fish, which is a serious objection to keeping the parent in confinement any longer than is absolutely necessary. The spawning operations are conducted on a platform over the compartments containing the ripe fish, which are accessible through hinged covers set in the flooring. When taking the eggs one or two men stand ready with dip-nets to hand the females to the spawn-taker, and one or more perform the same office with the males. After the salmon are taken from the pens they are held suspended in the net until their violent struggles are over, after which they become quiet enough to handle and the eggs and milt can be expressed easily. All methods of taking salmon spawn are very much the same. Where there are plenty of assistants, and the salmon are of medium size, the most expeditious way is for the man who takes the spawn to hold the female in one hand and press out the eggs with the other, another in the meantime holding the tail of the fish. The male is handled in the same way. But on the Columbia River, where the salmon is larger and harder to manage, a "strait-jacket" is used. This is a sort of a trough made the average length of the salmon and hollowed out to fit its general shape. Across the lower end is a permanent cleat and across the upper a strap with a buckle. The fish is slid into the trough, the tail going down below the cleat, where it is securely held, and the head is buckled down with the strap. Under this control it cannot do itself nor anybody any harm and the eggs can be pressed out easily. The strait-jacket is indispensable with the very large salmon, and when operators are few.

One man presses the eggs from the female securely held in the spawning box into a pan held by another. As soon as the eggs are taken the male is drawn from the pen and the milt is pressed from him into the pan in the same way. Milt enough is taken to insure its coming in contact with each egg, after which the pan is gently tilted from side to side and the mass stirred with the fingers until thoroughly mixed. The pan is then filled about two-thirds full of water and left until the eggs separate, the time varying from one to one and a half hours according to the condition of the atmosphere. The average size of the eggs is about one-fourth inch.

The hatching apparatus generally employed on the Pacific Coast consists of a combination of troughs and baskets. The troughs are 16 feet long, 12 or 16 inches wide, and about 6 inches deep. These are divided into compartments just large enough to allow the baskets in which the eggs are placed to be lifted in and out. The egg receptacles are wire trays about 12 inches wide, 24 inches long, and deep enough to project an inch or two above the water (in order that the eggs might not wash out), which is 5 or 6 inches deep in the troughs in which they are placed. Into each of these baskets two gallons of eggs, equivalent to about 30,000, are poured at a time. The eggs suffer no injury whatever from being packed together in this manner, the water being supplied in a way that forces it through the mass, partly supporting as it circulates among the eggs from below. The meshes are too small to allow the eggs to pass through, though the long, slender fry may pass when the eggs are hatched. The eggs are kept in water averaging 54 deg. F. for about 35 days. The allowance of five days' difference in time of hatching for each degree of change in the water temperature is about what is necessary.

The eggs hatch very gradually at first, only a small portion of the fish coming out the first day; but the number increases daily until the climax is reached, when large numbers of young burst their shells together. At this time great care and vigilance are required. The vast numbers of shells clog up the guard-screens at the outlets of the troughs, which must be kept as clear as possible by thoroughly cleansing them quite often.

After the eggs are all hatched and the young fish are safely out of the trays and in the bottom of the troughs their dangers are few, and they require comparatively little care. Almost the only thing to be guarded against now is suffocation. Even where there is an abundance of water and room, with a good circulation, they often crowd together in heaps or dig under one another until some of them die from want of running water, which is not an inch away from them. The only remedy in such cases is to thin them out.

At hatching the young salmon is about an inch long, and has hanging under him a comparatively enormous sack, the "yolk-sac." For a month he eats nothing, living on the essence of vitality stored in the sac. When the yolk-sac has nearly all been absorbed the fish rise from the bottom of the trough, where they have previously remained, and begin to swim. They are now almost ready for food and must be liberated into the streams for which they are intended, or artificial food must be provided them. As a rule the fry are planted at this time. This is regarded as the best practice, and moreover the amount of space required renders the rearing of fry impracticable. They have, however, been successfully retained in troughs from the time they begin to feed, in February, until the middle of May, when on account of the rising temperature of the water they have to be liberated.

For the first few days salmon eggs are very hardy, and at this time they are thoroughly picked over and the dead ones removed, as far as possible, before the delicate stage during the formation of the spinal column comes on, so that in the critical period they may be left in perfect quiet. As soon as the spinal column and the head show plainly the eggs are hardy enough to ship, but when there is time enough a wait of a day or two until the eye-spot is distinctly visible, after which the eggs will stand handling and may be safely shipped if properly packed, is generally allowed.

The packing box used in shipping eggs is made of half-inch pine, 2 feet square and 1 foot deep. At the bottom is placed a thick layer of moss, then a layer of mosquito netting, then a layer of eggs, then mosquito netting again, then successive layers of moss, netting, eggs, netting, and so on to the middle of the box. Here a firm wooden partition is fastened in and the packing continued as before. The cover is then laid on top, and when two boxes are ready they are placed in a wooden crate, made large enough to allow a space of 3 inches on all sides of the boxes. This space is filled with hay to protect the eggs from changes of temperature, and the cover being put on the eggs are ready to ship. In the middle of the crate an open space about 4 inches in depth is left, between the two

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boxes of eggs, for ice. As soon as the crates arrive at each railroad station this space, as well as the top of the crate, is filled with ice. Recent experiments show that salmon eggs can be packed and transported a considerable distance when they are first taken.

During the earlier years of the Commission young fish and eggs were carried by messengers in the baggage cars, but as the work increased it was found that this method was inadequate and that other arrangements must be made to transport the large quantities the department was handling. After experimenting in the years of 1879 and 1880 with a special car, the Commission fitted out several and has now in operation six. While they differ slightly in construction and arrangement, they are essentially alike. The frame of the car is so braced as to permit of two large doors in the center, extending from floor to roof, which simplifies loading and unloading. Underneath, between the trucks, is a reservoir tank which holds 600 gallons of water. In one end of the car is an office, an ice-box of 1½ tons capacity, and a pressure tank with a capacity of 500 gallons of water. At the other end are the boiler room and kitchen. The tanks and cans used in transporting fish are carried in two compartments running along the side of the car between the office and boiler room. They are 30 feet long, 3 feet wide, 25 inches deep. In the middle of the car, over the compartments, are four berths and several lockers for the use of the crew. The office is fitted up with two berths, lockers, writing desk, and typewriter. In the boiler room are a 5-horsepower boiler, furnishing the necessary power; a circulating water pump, and an air and feed pump.

For the transportation of ordinary fry 10-gallon iron cans, tinned, are used, 24 inches high, 12 inches in diameter on the outside, with sloping shoulders and cover. The water is introduced by means of a rubber hose connected with the pressure tank, or simply with a dipper and bucket.

For the transportation of large fish, the cars are equipped with twenty-two tanks holding 52 gallons each. They are provided with an overflow which connects with a supply tank under the car and can be drained by means of a valve at the bottom. The supply of water is carried in the iron pressure tank located in the body of the car next the office. The water is circulated by means of a steam pump through galvanized-iron piping, which runs from the pump to the pressure tank, thence along the sides of the refrigerator to the transportation tanks, whence it flows by gravity to the tank below the floor. From here it is pumped into the supply tank for redistribution.

To provide sufficient air circulation, the air is driven by a pump to a 30-gallon reservoir in the top of the car, from which it is taken to the transportation tanks or cans through two lines of iron piping running along the sides and top of the car. There is one pet-cock in the pipe for each tank to be supplied with air, which goes into it through a hole 1-32 inch in diameter. The car has also a hatching outfit.

Besides the distribution through these special cars, a number of special messengers act independently. Each one is supplied with a number of 10-gallon cans, a dipper, a 5-gallon iron pail, a large tin funnel, with a perforated bottom; a thermometer, a piece of hose for use as a siphon, and a supply of ice.

The Commission has three vessels in use prosecuting the marine work, the steamers "Albatross" and "Fish Hawk" and the schooner "Grampus." The "Albatross" is fitted with appliances for deep-sea dredging and collecting work, and is used for surveying and exploring ocean bottoms and investigating marine life. The "Fish Hawk" is in reality a floating hatchery, and is engaged in hatching shad, lobsters, and mackerel, in collecting eggs and in distributing fry, besides making topographic surveys of fishing grounds, etc. The "Grampus" is used in general work, but mostly in the propagation and distribution of cod.

The cod is propagated artificially on a more extensive scale than any other marine fish. Up to and including the season of 1896-7 the number of cod fry liberated by the Commission on the east coast was 449,764,000. The output of fry in the last-named year was 98,000,000.

The work of the Fish Commission, if exploited in full, would consume several volumes. To tell in the briefest the story of how each fish is saved from extermination by the battle that the Commission wages is beyond our scope, and many of the individual descriptions would be to other than the fisherman and the fancier a practical repetition. And yet the artificial propagation and distribution of fish cannot be dealt with in general without sacrificing many of the interesting points. So the first fish foods of the world, in quantity, have been selected.

The work of the Commission is carried on at 25 stations or hatcheries, located at suitable places throughout the country. At Woods Holl and Gloucester, Mass., cod, mackerel, lobster, and other important species are propagated and the fry are deposited on the natural spawning grounds along the coast. At Battle Creek, Baird, and Hoopa Valley, in California, at Clackamas, in Oregon, and Little White Salmon River, in Washington, the eggs of the Pacific salmon are collected and hatched and the fry are planted on the spawning beds in the neighboring streams. The Atlantic and landlocked salmon are cultivated in Maine at Craig Brook and Glen Lake to restock the depleted streams and lakes of New England and northern New York. On the Great Lakes at Cape Vincent, N. Y., Put-in-Bay, Ohio, Alpena, Mich., and Duluth, Minn., the work is with whitefish and lake trout. Hatcheries in the interior at St. Johnsbury, Vt., Wytheville, Va., Northville, Mich., Manchester, Iowa, Bozeman, Mont., Neosho, Mo., Quincy, Ill., San Marcos, Tex., and Leadville, Col., maintain in the inland lakes and streams the supply of brook trout, rainbow trout, black bass, crappie and other fishes. During the spring on the Potomac, Delaware, and Susquehanna rivers shad are hatched and distributed in nearby streams along the coast.

Santos-Dumont's Airships to be Used by the French War Department.

Santos-Dumont lately offered to place his new airships at the disposition of the French government, so as to determine their value in military operations. The government has accepted his offer, and proposes to make a series of trials with the airships, which will be of the greatest interest. At the annual military review, which was held at Paris on the 14th of July, Santos-Dumont sailed over the maneuvering grounds with his small airship "No. 9," which was recently illustrated, and went through a series of evolutions showing the ease with which the balloon could be managed. This performance was admired by the military authorities and the thousands of spectators who were assembled at Longchamps. Not long after this occasion the Minister of War, Gen. André, received a letter from Santos-Dumont, offering to put his airships and personal co-operation at the service of France in case of war with any other nation, excepting those of North and South America. In reply to this offer he received a letter from Gen. André, which it will be of interest to give in full:

"In the course of the review of the 14th of July I had occasion to remark and admire the facility and surety with which you made the evolutions with your airship. It is impossible not to acknowledge the great step in advance which you have made in aerial navigation. It seems that owing to your efforts it can now be applied to practical ends, and especially to military operations. I consider, in fact, that the new airships can render very great services in time of war. I shall be therefore very happy to accept your offer to place your aerial fleet at the disposition of the government, and in its name I thank you for your kind offer. I have appointed Commandant Hirschauer, of the First Battalion of the Aerostatic Corps, to examine with you the dispositions which are to be taken in order to put the matter into execution. Lieut.-Col. Bordeaux will assist that officer in his examination, in order to keep me informed as to the results of your collaboration."

As a result of this correspondence Santos-Dumont received a visit from the two officers delegated by the Minister, in his new balloon shed at Neuilly. During two hours the officers remained with the aeronaut, examining the great airship "No. 10," which is now in construction, trying the new 60-horsepower petrol motor, starting and stopping the immense propeller, and carefully studying the balloon in all its details. The officers made such a favorable report after this examination that the minister decided to proceed with a practical test, which will be held in the near future. If the trials succeed, they will prove the value of the airship in military operations. The test will probably consist in making the trip in a single day from Paris to one of the fortified places on the frontier, either Nancy or Belfort. It will not be necessary, however, to make the whole trip in the airship. Santos-Dumont's project is to leave Paris by train early in the morning, carrying with him the balloon envelope, hydrogen tubes, and all the apparatus, then to stop at a short distance from the city which is chosen. A detachment of soldiers who are to accompany the officers delegated by the minister would then uncouple the car containing the balloon and its accessories, and dispose the airship for its flight, under the aeronaut's direction. Santos-Dumont considers that two hours will be sufficient for the preparation, and he will then make the attempt to pass above the city named for the experiment.

The aeronaut has recently returned from a trip which he took to Brazil on the advice of his physician, as he was suffering from overwork. On reaching Paris he expects to complete the "No. 10" as soon as possible, in order to make the above trials. The new airship for the St. Louis contest is already in construction, and will be described shortly. One very gratifying result of the aeronaut's trip to South America is that the Brazilian Congress will very probably vote a prize of $100,000 for an international aerostatic contest, which is to take place near Rio Janeiro from May to December, 1905.

Correspondence.

Utility of the Scientific American.

To the Editor of the SCIENTIFIC AMERICAN:

We at present receive regularly the SCIENTIFIC AMERICAN, and use it as a newspaper of arts and sciences, and also select the more permanently valuable articles and cuts, filing them in what we call our "Industrial Library," from which they are drawn to be used as illustrative matter in class work, or by pupils interested in one or another subject.

We would be glad to learn of any other ways to use the paper educationally. ARTHUR W. RICHARDS.

The Ethical Culture School, New York City.

[Mr. Richards is perhaps utilizing the material in the best possible way. In too many schools, however, copies of the SCIENTIFIC AMERICAN are not preserved. In our judgment two copies of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT should be subscribed for. Bind one copy of each for reference, and cut up the remaining copy, classifying the subjects carefully. Mount the illustrations and text on stout manila paper with paste. In a few years such a collection will prove of the utmost value. The usefulness of such a plan is not confined to schools. We would like to hear from our readers relative to this matter. —ED.]

Static Electricity in the Separation of Metals.

To the Editor of the SCIENTIFIC AMERICAN:

Being a frequent reader of your valuable paper, I notice under the head of Electrical Notes in your issue of September 12, page 187, a published communication of Mr. D. Negreano made to the Paris Academy of Science, in which is described a process for separating metallic powders from inert matters by the use of static electricity. We wish to call to your attention the fact that several patents were granted to inventors in this country several years ago in which the principle described in Mr. Negreano's communication is utilized. Two patents granted to Mr. W. L. Steele and the writer, issued March 26, 1901, Nos. 670,440 and 670,441, use static electricity in the separation of metals or conductive particles in a pulverulent mass from the silicious or non-conducting particles of the same, by exposing such a mass on a suitable conveyer which is electrostatically charged from a Wimshurst machine, and supporting above the conveyer a metallic screen that is either connected to the ground or the opposite pole of the Wimshurst machine.

In the operation of this process the entire mass of pulverulent material is attracted to the screen; but the metals or conducting particles, by reason of their superior conductivity, quickly lose their static charge in the immediate vicinity of the screen, while the non-conducting particles pass through it, and are disposed of by a suitable air blast or other mechanical means.

This process has successfully operated on ores in separating metallic values from the gangue.

H. M. SUTTON.

Dallas, Texas, September 29, 1903.

Bertelli's Studies of Bird Flight.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the very interesting and instructive article, "The Flight of Birds Mechanically Studied," in the October 10 issue of the SCIENTIFIC AMERICAN, the writer alludes to the fact of the results being seemingly paradoxical, but if it be remembered that any current of air (as in the St. Louis cyclone of some years ago, and at the so-called Flatiron Building, New York, the walls and glass were blown outward, as explained by the undersigned at the time of those occurrences) produces a partial vacuum along its path toward which the surrounding air rushes in to fill the void, the phenomenon illustrated in the cuts will easily be understood and admitted.

May be, also, the learned professors who are engaged in this experimental work, will allow me to call their attention to the conclusion I arrived at some five years ago, as set forth in a correspondence of mine published in La Presse, Montreal, to wit, that in soaring, the bird's wings, concave underneath, act as a parachute, and that the great heat from the bird's lungs and body, as any one can see for himself by applying his hand to the breast of the bird, must again rarefy the air beneath the wings, and thus cause the underlying atmosphere to have a reactive and upward tendency, and thus also, so far, diminutive of the bird's tendency to fall.

The competition between the various aerostats which is to take place at the forthcoming exhibition at St. Louis, when the many forms of aerial vehicles are to be submitted to practical trial, cannot but render this exhibition the most interesting and instructive the world has ever seen, and cause thousands to go there who, but for such an exhibit, would have stayed at home. C. B.

Quebec, October 13, 1903.

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THE DISPOSAL OF NEW YORK'S REFUSE.

The scientific disposal of the refuse of New York city can hardly be said to have been undertaken until comparatively recently—indeed, not until the appointment of the late Col. George H. Waring, Jr., as Commissioner of Street Cleaning. Before the advent of his ever-memorable administration, the wastes of the city had been removed in a way which would have done credit to a medieval town, but which was shockingly discreditable to the most progressive community in the world. Garbage and ashes were indiscriminately piled on scows, towed either out to sea and dumped, or to tide lands which had been bulkheaded. Both plans were equally cheap and unsanitary. The first resulted in polluting the beaches of New Jersey and Long Island; the second, in rendering positively uninhabitable the vicinity of the tide lands. Despite the fact that the residents along the seashore complained bitterly of the defilement of their beaches, and the courts prohibited the dumping of garbage in places where the heat of the summer was sure to breed stenches almost insupportable, New York continued to dispose of its wastes in this disreputable fashion. Finally, sumptuary legislation effected a partial improvement. Even then the dumping of garbage at sea continued unabated.

One of the first orders issued by Commissioner Waring commanded householders throughout the city to separate their refuse material, to deposit in one receptacle the garbage that had accumulated through the day and in another the ashes from the fires, and to tie up in a package the rubbish and waste paper that had been formerly mingled with garbage. After that order had been carried out with the combined assistance of the Police and Health Departments, the beneficial effects of household separation began to be felt. Wastes were far more expeditiously removed than had theretofore been possible. Garbage was sent to Barren Island, where a private company converted it by chemical processes into commercially valuable products; the rubbish was picked by Italian laborers, employed by men who paid the city thousands of dollars for the privilege, as a partial return for the valuables found in the dumps.

The Tammany administration which came into power after Col. Waring's term expired, all but undid the good work which had been accomplished. Under the present energetic administration of Commissioner Woodbury, Col. Waring's methods have not only been carried out with renewed vigor, but many a decided improvement has been inaugurated. So completely new was the problem of scientifically disposing of the city's refuse at the time when Col. Waring first took charge of affairs, that the most he could hope to do was to get rid of the collected material as quickly and as cheaply as possible. The present Commissioner has gone even further. He has actually succeeded in converting much of New York's refuse material into a positive source of revenue for the city. Col. Waring's system of primary separation is again enforced. Garbage, as before, is towed out to Barren Island to be converted into useful compounds. Over a hundred thousand dollars is paid to the city for the picking of the rubbish containing valuables which have been swept by householders into the rubbish heap; the ashes are sold to contractors as a filling material, or else are dumped behind a crib at Riker's Island, with the result that the city is fast acquiring land worth $10,000 an acre. This, in brief, is the work which has latterly been accomplished in New York city.

In order to understand clearly just what is being done to better the sanitary conditions of the city, it becomes necessary to explain the meaning of certain terms, and also to give a few statistics to show something of the scope of the problem solved. By "garbage" is to be understood kitchen or table waste, vegetables, meats, fish, bones, and fat; under the general term of "ashes" are included not only furnace and stove ashes, but also sawdust, floor sweepings and street sweepings, broken glass, broken crockery, oyster and clam shells, and tin cans; "rubbish" is classified into bottles, paper, rags, mattresses, old furniture, carpets, and the like. Every working day some 9,920 cubic yards of ashes, 3,404 cubic yards of rubbish, and 1,399 cubic yards of garbage are collected in the boroughs of Manhattan, Bronx, and Brooklyn. The total annual amount is, therefore, equal to 3,096,091 cubic yards of ashes, 1,061,913 cubic yards of rubbish, and 437,515 cubic yards of garbage. The area from which this refuse material must be collected is equivalent to 949 miles of paved streets in the three boroughs mentioned. Geographically, New York city, with its enormous water frontage, is admirably situated for the rapid removal of this vast amount of refuse material. And yet in the two boroughs of Manhattan and Bronx there are but twelve water dumps and eight land dumps; in Brooklyn, but one water dump and twenty land dumps. This almost absurdly low number of points for the loading of material upon scows is to be accounted for, not by any lack of energy in the Street Cleaning Department, but in the hostility of property owners, who have used every legal means in their power to prevent the establishment of new dumps, despite the fact that the Street Cleaning Department's work is thereby seriously hampered. Between 47th Street and 134th Street on the North River, a distance of nearly five miles, absolutely no dump whatever is to be found. As a result, it is necessary to cart the material at great expense over a great distance to the nearest available wharf. When it is considered that the annual cost of carting in New York city is not very much less than that of sweeping (the actual figures being respectively $1,648,492.25 and $2,090,392.87) the fruit of this opposition becomes apparent. In the end the taxpayer must suffer.

Rubbish on the Traveling Conveyer Belt. The Pickers Sort Out Over Half the Material and Sell it; the Rest is Conveyed to the Furnaces.

Thus far the attempts of the city of New York to destroy its garbage totally by incineration have not proven successful. An experimental plant installed in the Borough of Bronx for the burning of garbage proved a failure. The city must, therefore, rely entirely upon the Barren Island plant, which is controlled by a private company, for the reduction of its garbage. In some European cities the practice of mingling the garbage with fuel has been tried, with more or less success. Indeed, sufficient power has been obtained to drive electric lighting plants, and thus to make at least a partial return for the cost of combustion. But actual profit by these experiments none of these cities can show.

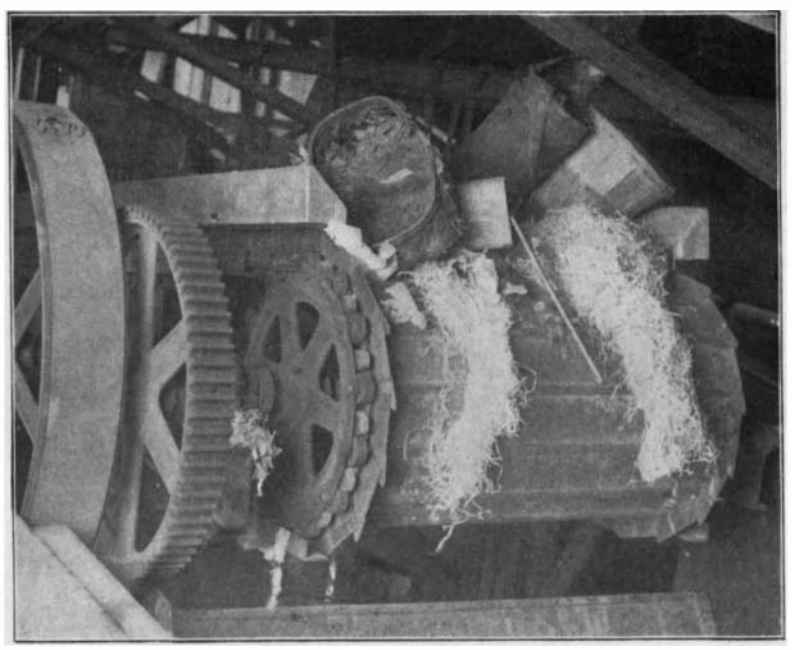
Although the burning of the garbage has not been as successful as it might have been, the same does not apply to the destruction of rubbish. At the foot of 47th Street and North River an incinerator has been installed, which has conclusively proven that not only can rubbish be burnt, but that the heat thus generated is sufficient to drive an engine for the propulsion of a belt conveyer, upon which the rubbish is scattered to be picked by Italian laborers. In time, an electric light plant will be operated, and steam engines driven, all from the power thus obtained. A brief description of this plant may not be without interest.

The carts containing the rubbish dump their loads on an endless conveyer belt, 104 feet long, traveling between two rows of pickers, who sort out certain material and drop it to the floor below. One picker selects manila paper, another shoes, another bottles, cans and metals, another cloth and rags, until finally fully sixty per cent of the material which New York householders consider worthless is picked out as worth saving. The metal consists of tin cans and is sold to sash-weight manufacturers; the paper goes to paper manufacturers, as do also the rags. The boots and shoes are either worn by the pickers themselves, or sold. Were it not for the fact that many of the sofas, bedsteads, and mattresses come from the poor quarters of the city, where disease prevails, and must for that reason be burnt, the amount of actual material supplied by the traveling conveyer to the furnace would be still less.

Paper, rags, and the like are at present baled by hand. Presses, however, are soon to be installed which will simplify the process considerably and also cheapen it. It is doubtful if this baling and selling of paper will be allowed to continue long. In the opinion of the Health Department paper is as much a source of contagion as a mattress or a sofa. At no distant day it will probably be dumped into the furnace with the other worthless matter.

Three fire boxes are provided. After having been picked, the rubbish is carried by the belt to the furnace hoppers and discharged on a single grate. In this manner the gases of combustion from one grate are made to mingle with those of a hotter furnace. The gases are discharged directly to a 114-foot stack, after passing beneath two 50-horsepower vertical boilers near the stack. There is heat enough for another boiler of 150 horse power. At this plant 150 loads of five cubic yards each are burnt every day. Since the actual cost of the plant was $20,000, and the privilege of handling the material brought to this point is sold at $240 a week, the rather good return of $2,480 per annum may be recorded.

Through the courtesy of Mr. F. L. Stearns, the engineer in charge of this plant, we are enabled to give some data and results of the actual efficiency of an incinerating plant based upon tests made by him. During a six-hour trial, with a single boiler plant on North Moore Street, 3,324 pounds of rubbish were fired upon grate surfaces of 40 square feet. The water-heating surface of the boiler is 324 square feet. It was figured that the actual horse power developed was 134.7, which is equivalent to 22.4 horse power per hour. The average weight of material burnt per yard was 175 pounds. From this it would follow that the horse power per yard of rubbish is at least 7.1.



Rubbish Discharged by Conveyer Belt Into Furnace Hopper.

For the towing of the garbage to Barren Island and for the removal of ashes to Riker's Island, twenty-six scows altogether are used. Up to 1895 the only dumping boat capable of handling the refuse of New York was the Barney scow, whose inventor had a very clear conception of what was necessary for successful operation, namely, an opening at the bottom of the cargo larger than that at the top, a clear run of water through the center of the boat when open, and the discharge of as much material in a single mass as possible. These boats do their work well, but are adapted solely for sea dumping; they will not dump when at rest, on account of the tendency of the two hulls to close after the first weight of the load has been removed. A boat was therefore proposed by Lieut. Com. Daniel Delehanty, which was designed and built by Lewis Nixon. The first boat, named with admirable fitness the "Cinderella," was faulty. Changes, however, were made which corrected these faults and prove the worth of the system. Two additional boats have since been built which have proven a marked success. The compartments in which the load is carried, between the pontoons, are wider at the bottom than at the top. This form of compartment does away with arching and bridging of the material on its downward passage, and moves the mass more or less as a unit according to the proportion of elements it contains, such as street sweepings, ashes, and the like. Typical of the entire fleet of dumping boats is the "Aschenbroedel," a steel pontoon steamer carrying its cargo of ashes and street dirt in seven compartments situated between two pontoons.

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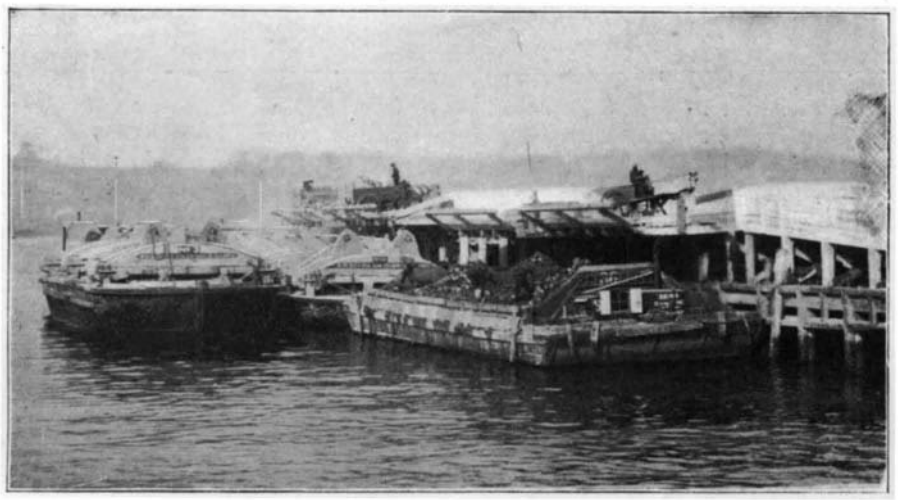
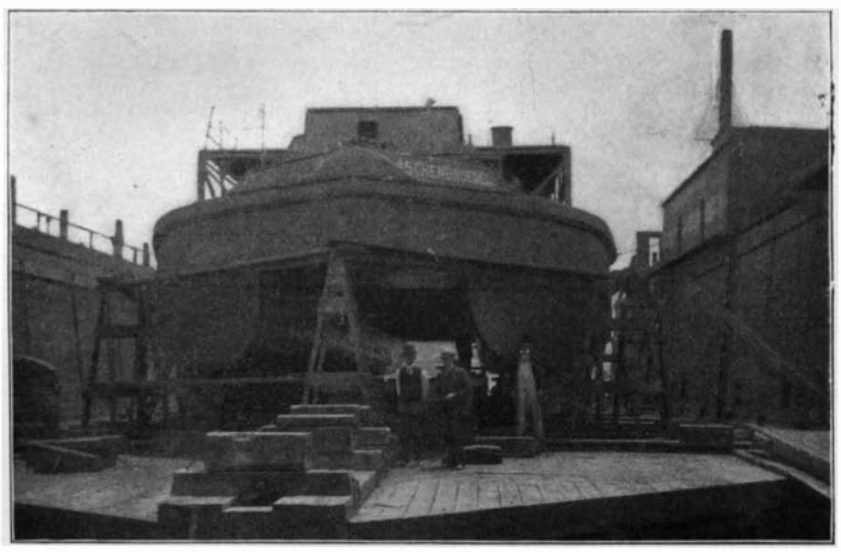


A Typical New York Dumping Board.

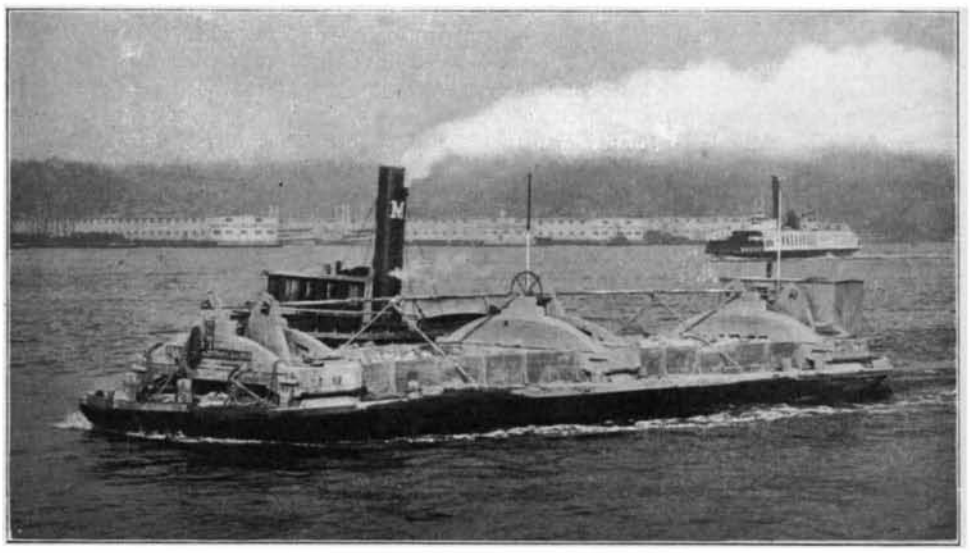
Barney dumper under outer board is receiving ashes; scow under nearer board is receiving garbage.

One of the New Steel Collecting Wagons.

A vehicle for the sanitary carrying of refuse.



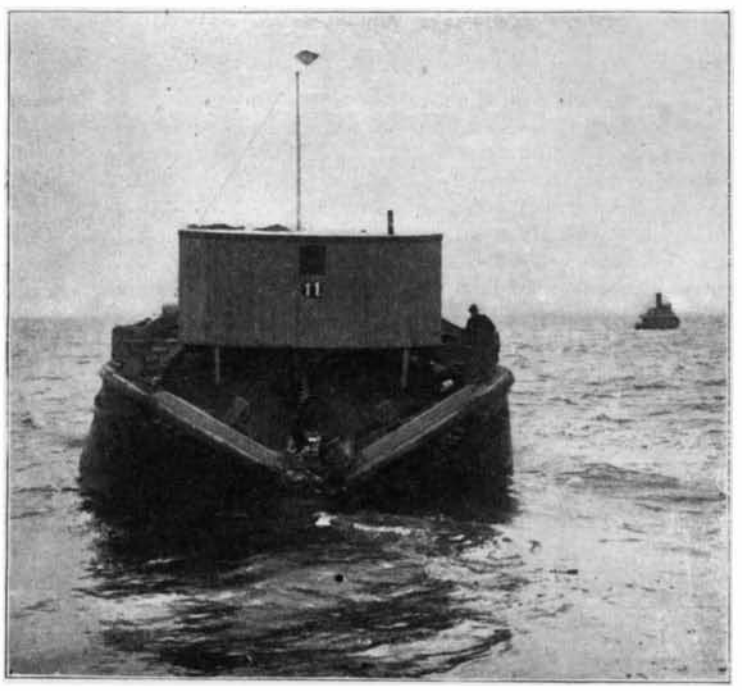
A Delehanty Steam Scow in Drydock, Showing the Double Pontoon Construction.



Towing a Barney Dumper Out to Sea.

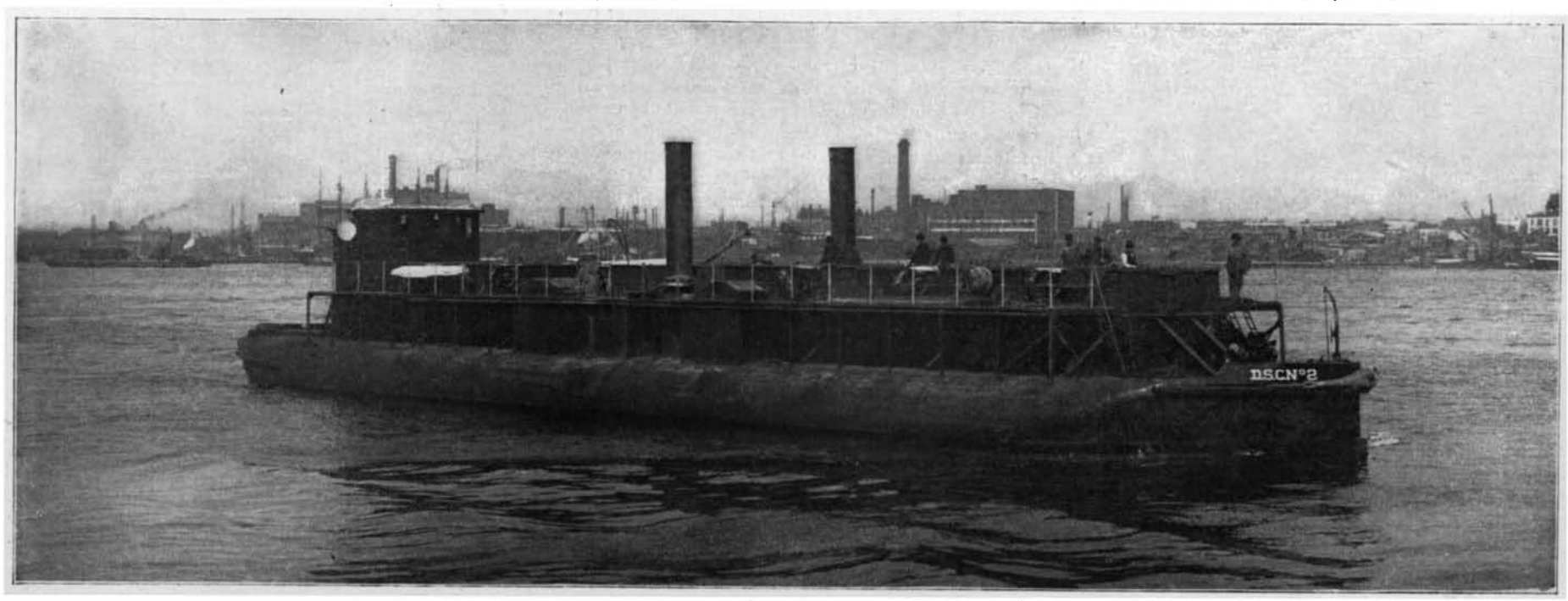
The Old Way of Dumping Garbage at Sea.

A former cause of the defilement of beaches in the vicinity of New York.



A Barney Scow in the Act of Dumping at Sea.

The two bulls have separated to discharge the material.



The Delehanty Automatic Steam Dumping-Scow "Aschenbroedel."

THE DISPOSAL OF NEW YORK'S REFUSE.

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Her dimensions are 140 feet over all; beam, 33 feet; draft, light 4½ feet, loaded, 7½ feet; beam of pontoon (amidships), 10 feet; depth of hold, 10 feet. In each pontoon is a compound surface condensing engine, with two cranks set at 90 degrees, the stroke being 14 inches, and the cylinders 12 and 24 inches in diameter. As auxiliary apparatus the vessel carries a circulating pumping engine, condenser, air pump, two feed pumps, two injectors, a fire and bilge pump, two ventilating engines, besides gearing controlling the cargo compartment doors. The vessel has a speed of eight miles an hour. Her capacity is 400 tons of ashes.

Commissioner Waring had adopted the plan of selling the manure street sweepings for use as a fertilizer. The termination of his commissionership and his untimely death unfortunately prevented him from carrying out this plan personally. Commissioner Woodbury has, however, realized to a great extent Col. Waring's idea, and is now selling 1,600 sacks daily to the Long Island division of the Pennsylvania Railroad for the grassing of cuts on the south side of Long Island.

Brief mention has previously been made to the filling in of land about Riker's Island with the ashes of the city. It is largely due to the present administration that in this manner land has been formed which in value more than offsets the cost of handling the filling material, and which has filled the city's pockets with thousands of dollars. In an empty crib inclosing 63½ acres, ashes have been dumped at the rate of 100,000 cubic yards per month. By this scheme the city has acquired land worth $630,000 at an expense considerably less than would have been entailed had the same material been towed out to sea and there dumped.

A HEAVY ELECTRIC LOCOMOTIVE.

The most powerful electric locomotive in the world has just been built by the General Electric Company at Schenectady, for the Baltimore & Ohio, for use in the tunnel at Baltimore. It will handle all the freight traffic of the Baltimore & Ohio which passes through Baltimore, and will operate over the same section as the present electrical locomotives built by the General Electric Company, and which have been in successful operation for the past eight years.

The specifications called for an electric locomotive capable of handling a 1,500-ton train, including the steam locomotive, but excluding the electric locomotive on a maximum grade of 1½ per cent at 10 miles per hour, with corresponding higher speed on lighter grades. This required a weight of approximately 160 tons on the drivers for purposes of adhesion, and it was decided that the most practicable scheme was to build an articulated locomotive consisting of two complete 80-ton units, operated together as one locomotive by means of the Sprague-General Electric multiple unit control system.

The section of the road to be operated runs from Camden Street Station, through the tunnel, to the summit of the grade outside the tunnel, a distance of 3½ miles. Under practical operating conditions the motors have sufficient capacity to maintain this service hourly, running loaded up the grade and returning light.

The whole locomotive consists of eight G. E. 65 motors, four on each section. These motors have a capacity of 225 horse power each, making a total capacity of 1,800 horse power. The main body of the truck frame consists of a rectangular framework of cast steel built up of four pieces, two side frames and two end frames, made strong and heavy. The parts are machined at the ends and securely fitted and bolted together, forming a strong and rigid structure capable of withstanding the most severe shocks without injury. The end pieces form the buffer beams, and to these a suitable standard draft gear of approved design is attached.

The journal boxes slide in machined jaws in the side frames protected by wearing shoes. The truck frames are supported at four points on equalizers. Each equalizer rests on a pair of half elliptic springs, the ends of which are supported on top of the journal boxes through suitable wearing plates. The journal boxes are made quite similar to standard car journal boxes, the parts, however, being made larger and stronger. The brasses can be easily removed, and by dropping down the wearing shoes it is possible to remove a complete journal box without removing the wheels and axles or other parts of the truck. In order that the locomotive may round curves easily, the axles are given considerable lateral movement in the journal boxes, reducing the effective rigid wheel base.

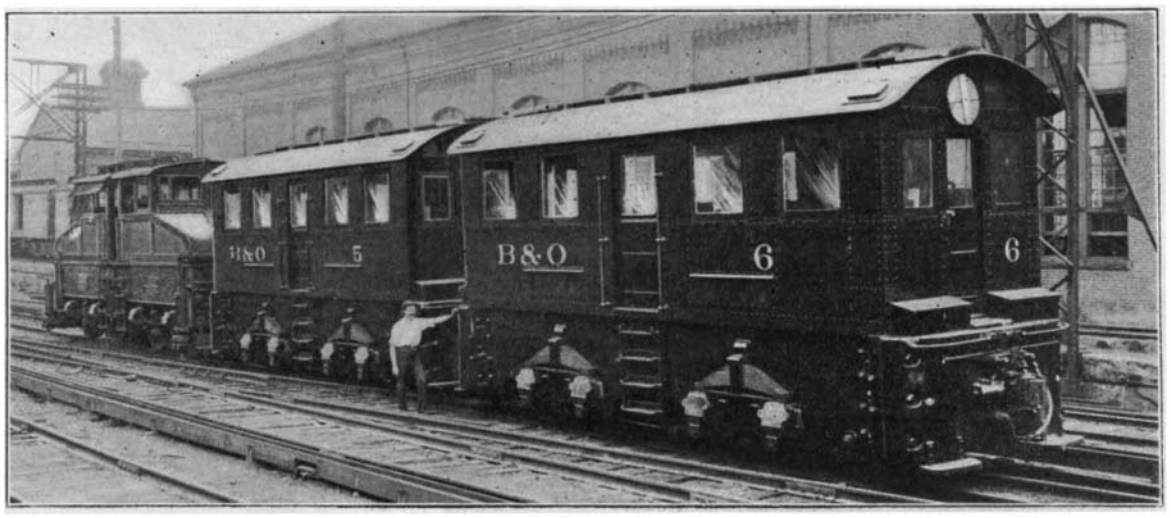
The steel-tired spoke wheels have tires 2⅛ inches thick, with M. C. B. standard tread and flange, and are securely held in place by approved fastenings. The axles are made of forged steel, machined all over, with 6-inch by 12-inch journals, 8-inch diameter wheel fit, and 7½-inch diameter motor bearings. The cab is large and roomy, with the floor resting on the truck frame. The lining floor is made of 1¾-inch hard pine, tongued and grooved, the upper floor of hard pine ⅞ inch thick, tongued and grooved, and laid in the opposite direction from the lining floor. The sides and roof of the cab are made of sheet steel. On each side there is an entrance door, and at each end there is an additional door, which permits of ready communication between sections when coupled together. Large windows afford an unobstructed view in all directions.

The controlling apparatus, consisting of master controller, engineer's valves, etc., is in duplicate, a complete set being located in diagonally opposite corners of each cab so that the engineer can stand in the front end of the locomotive when running in either direction.

Each section of the locomotive is equipped with a bell and whistle, two locomotive headlights, air-brake apparatus, including two engineer's valves and air gages, the necessary brake cylinders, foundation brake gear, air reservoirs, couplers, draft gear, and pneumatic track sanders. The control system is so arranged that each section may be operated independently, or two or more sections coupled together.

The Pennsylvania Railway Tunnels in New York.

The plans for the construction of the Pennsylvania Railway tunnels under the North and East rivers have been decided upon. The North River tunnel will comprise two single cast-iron tubes entering the city at the foot of West Thirty-second Street and running underneath that street. The shield process will be used in its construction. In order to insure safety, the tunnel will be provided with two concrete sidewalks on a level with the car windows, the object being to provide exit for the passengers in case of accident. The warning given by the recent Paris disaster has not been ignored. The plans include a lighting current separate from that which operates the cars. Numerous hydrants and hose nozzles will be provided in case of fire. The East River tunnel will be similar in construction to the North River tunnel, but will carry four tubes.



THE OLD AND NEW ELECTRIC LOCOMOTIVES OF THE BALTIMORE & OHIO RAILROAD.

New Balloon Experiments of Count Zeppelin.

According to the Swiss journals, a new activity reigns at Manzell, on the eastern shore of Lake Constance, which has become celebrated from the airship trials of Count Zeppelin. It appears that the aeronaut, whose emulation is awakened by the results of the recent airship trials, has decided to begin a new series of experiments. It will be remembered that after making several trips over the lake with his immense balloon, he was obliged to abandon the experiments for lack of funds. Count Zeppelin is firmly persuaded that the dirgible balloon will soon enter the domain of practice, and is now to renew the trials which have already cost such a large outlay.

The danger from electricity, particularly for the fireman in directing a stream of water upon an object carrying electric current, was the subject of an article in a recent issue of Energie, of Berlin, recording the results of a number of tests. A man wearing wet shoes and standing on a wet plank flooring, threw a jet of water on an electrified plate. At 500 volts and an aperture of 0.74 inch in the nozzle, he felt the current at a distance of 2¾ feet, and with an aperture of about 2 inches could not get nearer than about 3¼ feet. Under the same conditions, but with alternating current, he could not stay within 8.2 feet, and at 3,600 volts he had to remain at a distance of 26¼ feet.

The Azure Sky—Its Cause.

BY J. W. DAVIDSON.

Everyone notices the blue color of the sky. It has grown familiar to us by daily observation from childhood, yet few persons realize the great scientific and artistic interest attaching to this beautiful color.

Sir Isaac Newton tried to explain the color in the year 1675, by referring it to the blue colors seen in thin soap bubbles used in his experiments. He thought the air above our heads was filled with small particles of water, which reflect the blue portion of the sun's light falling upon our earth, and thus produce the blue tints of the firmament.

Sir John Herschel explained the color of the sky by Newton's theory, but later writers have proved that in some important respects his theory was wrong.

In 1869 Prof. John Tyndall, the famous British physicist, found that he could produce "sky blue" by experiments in the laboratory.

For this purpose he filled a glass tube about a yard long, and three inches in diameter, with air of one-tenth the ordinary density mixed with nitrite of butyle vapor, which is extremely volatile. Then on passing through the mixture a powerful beam of electric light, in a room otherwise dark, the mixture precipitated a beautiful blue cloud, which in color rivaled the finest Italian sky. Further experiments proved to Tyndall that he had at last discovered the secret of the blue color of the sky, which had puzzled the greatest philosophers of all ages.

Lord Rayleigh, the famous professor of experimental physics at Cambridge, England, and one of King Edward's original twelve members of the new Order of Merit, has investigated Tyndall's theory of the color of the sky by profound mathematical researches extending over many years. He confirms Tyndall's theory that the blue arises from the reflection of sun's light from small particles in the air less than one one-hundred-thousandth of an inch in diameter. Billions and trillions of these atomic particles fill the atmosphere, and by reflecting the blue part of the sun's light give the dome of the heavens a bluish tint.

Some of the particles are water; but most of them are composed of the oxygen and nitrogen which we breathe.

Prof. T. J. J. See, of the United States navy, is one of the American scientists who have studied the subject in another aspect. He has observed the color of the sky in various altitudes in high mountains, and in dry and moist countries, such as Egypt and Greece, and Arizona, and the Mississippi Valley. His conclusion is that the beautiful red colors of sunsets and sunrises so much spoken of by Greek and Roman writers, and so often illustrated in landscape painting, arise from water vapor in the lower layers of our atmosphere, absorbing the blue and transmitting the red light. According to Dr. See, the reddish colors come from that part of our air within five miles of the earth's surface, while the deep blue of the sky arises from reflections of minute particles in the higher parts of our atmosphere. The water vapor does not extend very high, clouds never rising higher than ten miles above the earth. The blue streaks cast by clouds at sunset show that the red arises near the earth, while the blue has its seat very high up. Above our atmosphere the sky has all the blackness of the darkest night.

Prof. See has watched the duration of the blue sky after dark, and found it to continue for about an hour and fifteen minutes, and from this he shows that our atmosphere extends to a height of fully one hundred and thirty miles. Astronomers have usually found the height of the atmosphere by computing the height of meteors, but none ever made the height of the atmosphere over one hundred miles.

The study of the blue color of the sky thus proves also that our atmosphere extends considerably higher than scientists have heretofore supposed.

On our dark days the blue color of the sky is shut out by clouds, and combinations of colors due to reflecting clouds and countless myriads of particles in the ethereal regions high above the earth give the bright light which is so much relished in daily life. The nature of the blue sky so much admired by all mankind since the days of Homer and Job, now fully explained by modern science, still preserves its ancient beauty, and will inspire man's mind through coming ages.

Among the interesting exhibits shown by Arizona at the World's Fair will be an ostrich farm.

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REMARKABLE CEREMONIAL GARMENTS.

BY WALTER L. BEASLEY.

The explorers for the Jesup North Pacific Expedition, equipped under the auspices of the American Museum of Natural History, to investigate the relation of the natives of northeastern Asia to those of the extreme northwestern part of America, have obtained valuable ethnological data, and collected many utensils and dresses intended to illustrate the daily life of the isolated tribes, while a careful study and comparison of this material will definitely aid, it is thought, in clearing up this great and hitherto puzzling problem. Dr. Berthold Laufer spent two years in carrying on researches among the inhabitants of the Amur River. Two of the most interesting tribes visited were the Gold and Gilyak. One of the surprising and astonishing features met with was that the everyday life of the people was not in keeping with their art. The Gold tribe was found to be a highly artistic race of men and women, producing and executing the most varied and elaborate designs in the way of embroidery. These were lavishly displayed on their wearing apparel and household effects. In physical appearance the Amur tribes are short of stature, with long hair. Though Russian subjects, they are almost isolated from government influences. They are a primitive community, incapable of reading or writing, and subsisting by hunting and fishing. Their province of art seems to be limited to the decoration of surfaces. The sense for plastic representation is lacking. Animal and facial carvings are rarely met with, save a few rude images belonging to the outfit of the shamans, which are not classed as works of art. The materials used by the Amur tribes for displaying their ornamentation are wood, birch bark, fishskin, elk and reindeer skin, and silk. The silks, as well as the coloring matter, are traded from the Chinese. One of the most unique and remarkable specimens obtained was a fantastically decorated shaman's coat, and a number of his grotesque carved images associated with his calling. The garment is made of elkskin, and is adorned with a series of animal and human figures, intended to typify the supernatural powers of the shamans. The dragon and other borrowed Chinese symbols are prominently employed. Identical decorations appear on both sides of the upper section of the garment; the lower being supposed to represent the forests of the animal world, with which the shaman has a close connection in order to effect his magical cures. The back of the garment is likewise ornamented with different designs. The figures are painted in red, yellow, and black. The mythology of the Golds is crude and fetish. It includes good and evil spirits, with the shaman as mediator. He is considered a supernatural personage able to drive bad spirits out of the body and otherwise effect miraculous cures in all diseases. When sent for by an afflicted tribesman, he appears dressed in his ceremonial coat. From his medicine chest he selects a rude figure of the animal typifying the wicked demon who has stolen the sick man's soul. If he has none in stock, one is hewn on the spot. This is placed by the bedside of the invalid. The shaman then commences (in spirit), accompanied by drum-beating and incantation, to take a long journey in search of the departed spirit of the sick man. After much imaginary resistance, he rescues the soul from the captor and restores the same again in the body of his patient. If by chance a recovery is effected, the shaman is usually highly rewarded for his services. The coat here figured is the first to be exhibited in America from this untraveled and remote region. Another extraordinary shaman's coat is considered of especial interest, from the fact that it is the only known specimen so far collected or known belonging to an Eskimo; besides, it comes from the most northern portion of land on the American continent. The coat is one of the principal features of a miscellaneous collection of Eskimo objects recently obtained by Capt. George Comer, an Arctic whaler, for the Museum. It was collected from tribes dwelling in and around Hudson's Bay, a territory difficult of access. These Eskimos have not come in contact with civilization or been visited by a white man for nearly a century, consequently they exist in the most primitive condition. The coat has an important ethnological significance, as it resembles in many details those worked by the shamans of the Chukchee and Koryak tribes of

The Symbolical Demons of a Shaman's Medicine Chest.

northeastern Siberia. This may indicate an early and long-forgotten connection between the tribes of this region with those on the opposite Asiatic coast. The coat is made of caribou skin, sewn with sinew and ornamented with figures cut out of the white skin of that animal's foot. The meaning of the symbolic design in figures on the coat is expained to Capt. Comer as follows: The two hands signify that no supernatural being can touch the shaman. On the back are two bears, which represent the guardian spirits of the owner, while the figure of a small boy, shown over the hands, calls to mind a vision which the shaman had when he received the supernatural power. The alternating circles of black and white fur are intended as good-luck omens to the owner, which will bring him success in seal-hunting, and success in his efforts to dispel bad spirits from the body. Mr. Waldemar Bogoras, who carried on researches among the tribes of northeastern Siberia for the Jesup Expedition, informed the writer of a remarkable phase of shamanism among the Chukchee tribe. While undergoing the initiation necessary to acquire shamanistic powers, such as refusing food, becoming pensive, and absenting himself from his fellow men, passing weeks, night and day, in the open air, far from home, suddenly the "new-inspired" receives a message from his spirits and he is at once transformed into a woman. He immediately dons woman's clothes, acquires a woman's voice, learns to perform woman's work, and forgets his former masculine knowledge. This fanaticism is carried to extremes, and in time the newly transformed is married to a man, and during the rest of his life performs the duties of a housewife.

Caribou-Skin Coat Obtained in Hudson's Bay.

Elk-Skin Garment with Symbolical Decoration.

REMARKABLE CEREMONIAL GARMENTS.

American Cars on English Railways.

English railways are adopting, where they can do so to advantage, many of those points of American railroad practice adaptable to English systems, and they are also endeavoring to compete with electric street car systems which already exist in fields competitive to their own, and to forestall and prevent the building of other lines by establishing railroad stations and automobile services through country districts as feeders to their own lines. As illustrating the subject, a speech of the chairman of the Great Western Railway Company, reported in the Times, may be cited:

"Having regard to the fact that the company was suffering from the competition of tram cars and also of motor cars, it had been decided to make an experiment in two directions. In the first place, they were about to establish a motor-car service, by means of a combined engine and car, between Stonehouse and Chalford, in the Stroud Valley. The cars would run on the company's lines and arrangements had been made for stopping not only at existing stations, but at intermediate points, for picking up and setting down passengers. In this way a fairly quick service would be provided for local people. The cars would be worked by steam and carry 52 persons. He thought it was an experiment of a hopeful nature. At any rate they intended to see what could be done in that way on branch lines and in certain congested parts of the country. The board had had under consideration many applications in respect of light railways, but they were doubtful as to whether there was sufficient traffic to justify the construction of such lines, and there were also cases in which private persons were running a motor-car service along the company's route. There seemed to be no reason why they should not themselves take steps to feed their railway by running motor cars, and instructions had been given for five to be purchased capable of carrying 22 persons each.

"The cars, which would be driven by petrol, would be built to travel at a moderate speed, and it was hoped that they would prove a convenience to the public as well as feeders to the Great Western system. In any case they would show what amount of traffic there was in a district. One advantage of motor cars was that, if the traffic proved insufficient, they could be moved elsewhere. The directors believed that it was an experiment which would have good results. In any event, the outlay involved was not heavy. The first service of the kind would be from Helston to the Lizard."

L. Fuerst (Zeits. für dietet. und physik. Therap.) strongly recommends levulose as a food for children. It may be used instead of saccharose or lactose to sweeten infants' milk, to which it imparts a pleasant flavor, while it never occasions the digestive disturbances to which the use of other sugars often give rise. Slightly older children, who often lose weight when weaned, take levulose chocolate and syrup readily. Levulose is of marked benefit to badly nourished children and to those recovering from illnesses. When given to children suffering from glandular enlargements, tuberculous or non-tuberculous, the effect on the glands is equal to that of cod-liver oil.

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RECENTLY PATENTED INVENTIONS.

Electrical Devices.

FIRE-SIGNAL.—J. H. Dixon, Pittsburg, Pa. The invention of Mr. Dixon relates to automatic fire-signals, and more particularly to the type in which a wire is made fusible for the purpose of sounding alarms. The object is to provide a cheap and practicable device for causing and transmitting signals in case of fire in a building with a minimum liability of signals being induced from other causes than fire.

Engineering Improvements.

STEAM-TRAP.—G. M. Hilger, Chicago, Ill. In carrying out this invention, which relates to improvements in steam-traps for receiving the water condensed from a steam heating or other apparatus, the inventor has particularly in view the provision of an extremely simple device which shall receive the water condensed from steam-coils or similar apparatus where it is required to remove the condensation in order to preserve what is commonly known as "dry" steam.

PUMP.—G. W. Meyer, Sparrows Point, Md. In this case the invention has reference to a duplex pump adaptable to all ordinary purposes, but especially adapted for use in places which are confined and otherwise difficult of access. It may be operated by any fluid under pressure; but compressed air is thought to be most effective.

ROCK-DRILL ATTACHMENT.—D. A. Owen, Poultney, Vt. The object of the invention is to provide a new and improved rock-drill attachment for drilling holes in rock to facilitate the splitting of the rock along a desired line of fracture or cleavage upon firing the explosive with which the hole is charged. The device can be readily applied to rock-drills now used, by changing the shank of the drill, to accommodate the cutter.

STEAM-TURBINE.—A. J. Taplin, Washington, D. C. Mr. Taplin's object is to provide a construction for driving the propellers, to provide the propellers in pairs, one right and the other left, and to operate them independently so they may be used singly or jointly for steering the vessel without the aid of a rudder. The mechanism secures greater screw capacity and speed in a vessel and controls the flow of fluid vapor—such as steam—in a manner to easily operate the reversible turbines and screws operated thereby to propel and steer without a rudder's use, with safety, economy and without vibration.

MARINE PROPULSION.—A. J. Taplin, Washington, D. C. The object in this case is to provide a mechanism for propelling the vessel, including draft-propellers, which may be operated by fluid-vapor, water, or other power, seeking to produce a vessel-propelling mechanism direct in operation, of minimum weight, of little or no vibration, which will occupy minimum space and will increase the carrying power, stability, and navigable properties of a vessel, and furnish a propeller and engine capable of driving a vessel at the greatest speed attainable with safety and economy.

REDUCING-VALVE.—S. Munson, Hastings, Neb. This valve is more particularly for use on air-brakes on railway-trains; and the object is to provide one of simple construction for gradually reducing the brake-cylinder pressure from eighty-five pounds to fifty pounds in about twenty seconds, when the fifty pounds pressure remaining in the brake-cylinder will be maintained until the train comes to a stop or the brake is released voluntarily by the engineer.

Hardware.

COMBINED LOCK AND LATCH.—A. M. Doyle, Leoti, Kan. This device is an extremely simple secure lock that is devoid of springs; may be locked or unlocked with a key or by manipulation, and a right and left hand latch that is reversible readily, is adapted to operate to lock it entirely by its gravity, and consisting of a single piece operative by a knob-spindle rotatable in either direction.

CHISEL.—N. H. Smith, Bonaparte, Iowa. The object in view is to provide a chisel with cutting edges so constructed that the fiber of the material being turned will be cut off in a smooth manner, not broken, and then rapidly removed. With this tool rapid, accurate, and smooth work in squaring up ends, removing superfluous grooves, either vertical or oblique, in making pulleys, rosettes, or disks is facilitated. It is useful and rapid in all face-plate work and in getting work ready for other tools.

PIPE-BENDING TOOL.—C. W. Miller, New York, N. Y. In this case the invention relates to improvements in tools for bending metal pipes, an object being to provide a tool by means of which a very considerable pressure may be brought to bear upon the pipe or tube, thus making it possible to bend pipes of comparatively rigid metal with little manual exertion and without danger of breaking the pipe at the bend.

Machines and Mechanical Devices.

CLOTH-CLEANING ATTACHMENT FOR FLOUR-BOLTS, ETC.—J. Charles. Charlton, Md. The object in this improvement is to provide means for brushing the cloth of flour-bolts, and to that end the inventor has constructed a useful attachment which while intended to be used in connection with flour-bolting machines having a gyratory motion is equally adapted to all sieves having a similar motion.

STAMP-AFFIXER.—J. Olsen, Jersey City, N. J. In this patent the invention relates to improvements in stamp-affixers; and the object is the provision of a device by which stamps may be easily and rapidly applied to letters and other pieces of mail-matter, the stamps being moistened, cut, and pressed in proper sequence to securely affix them.

JACK.—W. R. Lewis, Montezuma, Iowa. In this invention the improvement refers to a screw jack, the leading feature of which is a novel ratchet arrangement for operating the jack, which may engage the screw jack in any position and may be applied to or removed from the screw at will. The jack may be readily handled and stored in a relatively small space.

RATCHET-LEVER.—L. P. Jacobs, Earling, Iowa. The intention in this case is to provide a lever whereby the initial movement of the lever toward the released position will operate automatically to release a dog from the rack-segment, thus dispensing with the necessity of separate devices on the handle of the lever for releasing the dog before the lever can be moved to released position. The invention is especially designed for use in connection with wagon-brakes.

WASHING-MACHINE.—E. A. Griffin and Hester M. Griffin, Altoona, Pa. One object in view in this invention is the provision of means for supporting a vessel so that it can turn freely and be capable of easy operation by hand. A further object is to retain a rubber in a stationary position within the oscillatory vessel by improved means, which permit the rubber to be raised or lowered and also allow the rubber to be lifted with the vessel's cover to a raised or opened position.

FLOUR-BOLTING MACHINE.—C. L. White, Anderson, Indiana. The present invention includes improvements in the means for imparting a swinging body movement to the cylinder of the machine; also, in the means for rotating independently of the cylinder proper the horizontal brushes which clean the parallel sieves and gathering-boards arranged below them; also, in the construction of such boards the better to deliver the sifted product to conductors arranged at the outer side of the cylinder. This invention is an improvement upon a former patent received by Mr. White.

REVERSIBLE TRANSMISSION GEAR.—J. A. Dickey, Columbus, Indiana. This apparatus is fitted with a clutch for directly connecting the driving and driven elements and a set of gears for connecting said elements to run the driven elements in the opposite direction, the clutch and gears being arranged the one to be inactive upon the other, and vice versa.

CAM.—W. H. Daily, Carthage, Ill. In carrying out this invention Mr. Daily has in view as an object the construction of a cam disk which shall take its load at a point farthest from the center or at the greatest point of leverage and shall release such spring at a point nearest the center or at the shortest point of leverage. By this means it is possible to compress a spring or a gas without the loss of any power save friction and with the least possible jar to the machinery and the operator.

PILL-COUNTING MACHINE.—W. Brough, Baltimore, Md. This improved machine is adapted to count automatically pills or other similar articles rapidly and accurately without injury or adhesion of one to the other. A distinguishing feature of the contrivance is an endless traveling belt having groups of sockets for receiving the pills or other articles to be counted, the pockets being so arranged as to facilitate discharge of the pills at the proper time in the travel of the belt.

Of Interest to Farmers.

HARVESTER.—H. Traeger, Auburn, Wash. In this patent the improvement relates to a machine for shelling and separating peas from the hull; and it comprises means for effecting these functions combined in a novel manner into a wheeled apparatus adapted to be associated with a cutting or harvesting apparatus and drawn through the field in which the peas are grown.

HOISTING DEVICE FOR SACKS, BOXES, ETC.—C. Serley, Wilbur, Wash. This is a simple, practical, and efficient device for hoisting and piling sacked grain, boxes, or other material in a very rapid, convenient and economical manner. By means of this machine two men can pile high about four sacks of grain per minute, which is more than twice the amount handled by the ordinary block-and-tackle apparatus.

LOADING OR UNLOADING APPARATUS.—W. T. Smith, Ames, Iowa. Though applicable to different purposes in the arts, these improvements have reference more especially to apparatus for loading and unloading shocks of hay, wheat, barley and other grain while in the field; and the principal object of the invention is to provide apparatus which is simple in construction and organization besides being thoroughly effective and reliable in operation, as well as capable of easy handling or manipulation.

HAY-LOADER.—C. J. Romwall and W. C. Pitt, Lovelock, Nev. The purpose of this invention is to provide a simple, durable, economic, and effective form of hay-loader especially adapted for use on large ranches where hay in quantities is to be gathered and stacked, the device being adapted to save the expense of shocking and pitching, and, in a measure, raking the hay into wagons.

Pertaining to Vehicles.

TRACE.—F. D. Thoman, Toledo, Iowa. The aim in this improvement is to provide a trace which has no leather parts to wear, one which is pliable and strong, readily attached and detached. The invention consists of a wire-cable body portion surrounded by a tightly-coiled covering of metal and detachable hame and whiffletree connections. This body-portion is surrounded by a waterproof covering which is in turn surrounded by a tightly-coiled covering of metal, with detachable hame and whiffle-tree connections.

BICYCLE-GEAR.—J. H. Trismen, New York, N. Y. The aim in this invention is the provision of a bicycle-gear more especially designed for transmitting the motion of the sprocket-chain to the rear or driving wheel of the bicycle in an economical manner, at the same time insuring a high speed to the bicycle and utilizing the power exerted by the rider or motor to the fullest advantage.

WAGON.—S. H. Boone and C. W. Staples, Burtts Corner, New Brunswick, Canada. In most low-down axles wagons the front of the wagon-body is of reduced dimension and is not available for receiving its proportion of the load. In this invention the wagon-body may be of full dimensions throughout, and it extends beyond the front axle, thereby accommodating a larger load. This principal advantage is due to the inventor's improved manner of mounting the body on the front axle.

TRUCK.—T. H. Brown, Sterling, Kan. By this invention a barrel of heavy goods, such as salt, can be picked up with ease and placed on a spot without touching it with the hands in loading or unloading. The clasp-arms work automatically and extend in front of the wheels, so that the truck being pushed in front of the barrel the arms roll and adjust themselves to the barrel below the quarter-hoop. The wheels being back, the clasps readily pass between adjacent barrels to position to engage with the quarter-hoops. Means are provided to pull the barrel onto the truck.

MOVING-VAN.—A B. Yetter, New York, N. Y. The purpose of this invention is to provide a construction in which the body is roller-supported upon a running-gear and means for retaining the van upon the gear while in transportation. After the body has received a sealed load, to provide means by which the body may be released from its fastening devices on reaching a storage-house and without impediment transferred to a platform-truck, so that the body can be carried to any position by an elevator or other means. A van-box so constructed dispenses with many handlings of transported material, saves time, and wear and tear of articles.

Railways and Their Accessories.

RAILWAY-SWITCH.—T. T. Chaloner, New York, N. Y. In the present patent the invention has reference particularly to improvements in railway-switches, and the object in view is the provision of a switch of simple construction that may be readily and positively shifted by a motorman or driver on a moving car.

AUTOMATIC BRAKE FOR RAILWAY-VEHICLES.—E. L. Cridge, Passaic, N. J. In this case the invention relates to an automatic brake for railway-vehicles, a more particular object being to devise means for automatically venting the air-brake of a locomotive, thereby causing the mechanical brakes to be applied in case the engineer disregards a semaphore-signal.

RAILROAD-RAIL HOLDER FOR METAL CROSS-TIES.—J. Katzenmeyer, Kirby, Ohio. The present invention refers to means for detachably holding the track-rails of a railroad secured upon metal or other cross-ties, and has for its object to provide novel features of construction for the purpose indicated. There is a special provision for accommodating the shifting ends of a track-rail and frog-tongue at a switch, this detail comprising the addition of a chair.

DUMPING-CAR.—W. H. Davis, Parachute, Col. In carrying out this improvement, which has particular application to railway dumping-cars, Mr. Davis has in contemplation the construction of a car of the "hopper-bottom" type, wherein a load of dirt, coal, ore, or similar material passing through an opening in the bottom of the car will be directed to predetermined points or places alongside the car and out of the way of the wheels thereof.

GRAIN-DOOR.—J. E. Drake, Blue Rapids, Kan. The purpose of this improvement is to construct a substantial grain-door for freight-cars, which door will involve few parts and none readily detachable, thus making it practically impossible for the parts to be stolen, as frequently happens at obscure railway-stations. The door is so constructed that when moved into inactive position it will not interfere with the use of the car for ordinary purposes.

BRAKE MECHANISM FOR CARS.—W. S. Howland, Old Saybrook, Conn. This mechanism includes main and supplemental or emergency devices for controlling the brake-shoes, the construction of both being applicable to any car, and such that the main brake may be used independently of the emergency brake, and whereby the supplemental mechanism may be almost instantly applied to the brake-shoes to add to their gripping power upon the wheels for stopping the car instanter even upon a decided downgrade.

SPARK-EXTINGUISHER.—J. W. Bryant, Crewe, Va. The improvement is adapted for use on locomotives, and the object is to provide a construction by which to thoroughly extinguish and pulverize the sparks and cinders without impeding the discharge of same from the stack, whereby the engine will be prevented from throwing sparks or fire, the draft of the engine will be increased, and the engine enabled to clean its front of all cinders and sparks, thus permitting of a practically perfect draft.

Miscellaneous.

SPUR ATTACHMENT FOR LEGGINGS.—W. C. Brown, U. S. Army. The object in Captain Brown's invention is to provide a spur attachment for leggings, such as used by cavalrymen and other horsemen, the attachment permitting the user to quickly remove the yoke and rowel from the supporting member whenever the user wears the leggings under circumstances that render spurs undesirable, the attachment also permitting immediate attachment of the yoke and rowel whenever desiring to use the spur for its legitimate purposes.

CARD.—E. B. Carpenter, Plymouth, Indiana. One of the important objects of Mr. Carpenter's invention is to provide a card readily attachable to any projection, such as a door knob or the like, the shape of the article being such that the likelihood of the card being disturbed will be obviated. Another object is to furnish an improved card with a tongue or extension cut from the material of the blank, such tongue serving as a support or brace for the card whenever it is desired to apply the same in an upright position.

ARTICLE-ATTACHER.—E. B. Carpenter, Plymouth, Indiana. In this patent the invention relates to improvements in an article for suspending and retaining canes, umbrellas, parcels, and the like. Great inconvenience is caused and many articles are lost through carelessness, when purchasing in large and crowded stores. The inventor's object is to provide means whereby articles such as those mentioned, may be connected with the person of the wearer, to obviate the possibility of losing the same.

CHIP-RACK.—S. A. Cohen, New York, N. Y. This game accessory has for its purpose the provision of a chip-rack which is arranged to permit easy and quick attachment to or removal from a table and to bring the rack in position for a player to conveniently place the chips into the rack or remove the same therefrom.

MAIL-BOX.—I. F. Collins, Sabetha, Kan. This mail-box is particularly adapted for use on rural mail-routes; and the object of the improvement is to provide a box so arranged as to protect the deposited mail-matter from rain or snow and which can be quickly opened and closed, resulting in a great saving of time in collecting and delivering mail.

MOUNTING FOR RIFLE-TELESCOPES.—C. E. Stallcop, Sac City, Iowa. The holders or mountings proper for the telescope in this invention are provided with springs which bear upon the telescope to press it both downward and laterally, and in connection with such mountings a graduated slide is provided which is practically wedge shaped and furnished on its inclined edge with an open slot whose shoulders are adapted to engage the mountings. By means of an adjustment the telescope may be lifted or pressed laterally and held in position.

HAT.—L. M. Stirewalt, Toledo, Ohio. The present invention is an improvement in hats, in which the inventor includes caps and similar head-coverings; and the object is the provision of a novel construction of ventilated hats aiming to avoid baldness and other injuries which result from wearing of air-tight unventilated hats.

COLLAR-FASTENING CLASP.—Caroline Lassén, New York, N. Y. This clasp is designed particularly for use in fastening collars used in connection with ladies' shirt-waists. Primarily the inventor's object is the provision of a collar-fastener which shall overcome the numerous objections to other fasteners, such clasp dispensing with pins and enabling such fasteners as hooks and eyes, buttons, and the like to be discarded.

PUMP ATTACHMENT FOR PORTABLE CANS.—P. J. Blackmon, Corsicana, Texas. This contrivance provides means for detachably connecting a liquid-lifting pump with an ordinary commercial packing-can containing coal-oil, and thus enables the convenient transfer of the liquid contents of the can into a lamp or other receptacle. The improvement facilitates the transfer of oil, prevents loss, and lightens the labor of filling lamps from the original packing-can.

MEANS FOR ATTACHING PINS TO METAL PLATES.—H. F. Nehr, Brooklyn, N. Y. As it is difficult or practically impossible to solder metal to aluminium, it is the general practice in making badges or the like of this metal to mechanically secure a brass or simi-

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a metal plate in the back of the aluminium slate, and to this brass plate the pin is soldered. This method requires considerable time and adds to the cost. Mr. Nehr's object is to provide a simpler means for securing the pins.

ACCOUNT-BOOK HOLDER.—A. J. SHAUL, Quimby, Iowa. This device is adapted for holding account and other books for containing records and which when not in use require to be deposited in safes. By means of stepwise adjustment the top or upper portions of the books permit of convenient inspection, and the names of parties with whom the accounts are kept being printed on such portions a selection may be instantly made. The book holders may be readjusted into a compact form, so as to occupy minimum space when stored in a safe or vault, without removal of the account-books.

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The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

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Inquiry No. 4710.—For makers of hot Winnie kettles for selling hot sausage.

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Inquiry No. 4712.—For makers of collapsible tubes.

Inquiry No. 4713.—For dealers in machinery for making starch from potatoes.

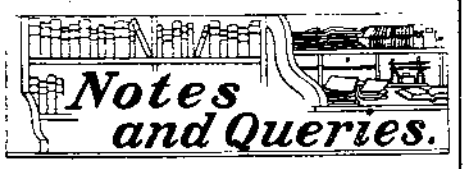
Inquiry No. 4714.—For the inventor of the machine for making cotton belting.

Inquiry No 4715.—For makers of novelties and specialties.

Inquiry No. 4716.—For makers of tools, gold wire and shells for making gold wire novelties.

Inquiry No. 4717.—For a device for keeping screen doors from blowing open and slamming with the wind.

Inquiry No. 4718.—For some good selling article for the winter months.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9206) J. A. McD. says: Could you inform me in regard to the welding of copper; is it still considered a lost art, or is it readily done over the country? Are there people looking for the secret? Would you say we can weld copper successfully? A. The welding of copper is not considered, so far as we are aware, a lost art. A number of companies are now welding copper without any serious difficulties, we believe; and the trouble which there has been in the past has been caused largely by the difficulty of getting sufficiently pure copper in the market. We know of no one who is looking for the solution of this problem.

(9207) C. W. says: Would you kindly inform me of the best method to pump sea water from a sandy beach, when at present considerable difficulty is experienced by the sand choking the pipe and steam pump, although the suction and X pipe is run out 200 feet from shore? Is there any way of keeping the sand out of a well if sunk on the beach? I suggested digging a well and sinking a barrel with the suction pipe cemented through the bottom and buried in the sand, but they tell me that the barrel would soon fill up from underneath; would that be so? Any information on the subject will be thankfully received, also as to what pump is considered the best for salt water. A. In reply to your inquiry regarding the best method of pumping water from a sandy beach, we would advise you to have your pipe run out as far as the conditions will allow and then have the pipe as large as you conveniently can, preferably with a flaring or funnel-shaped opening, so that the velocity of the water as it enters the pipe will be very small. Extending your suction pipe another 50 feet into the ocean would not appreciably increase the work on the pump. The additional work would be caused only by the slight amount of additional friction. For pumping salt water, it is best to have a pump with a bronze-lined cylinder, a bronze piston and piston rod, and bronze valves. Almost any of the well-known pump manufacturers will be able to furnish you with such.

(9208) N. P. says: 1. Give a formula to find how many horse power I need to run this machine: Driving shaft, 130 revolutions, 20-inch pulley; machine, 66-inch pulley, 9-inch belt, 40 revolutions. 2. Name of a small book containing similar formulas. 3. They write me from Italy about a much-advertised American invention—a Muller's "acousticon" for deaf and dumb. Muller is from Alabama, and his "acousticon" was experimented with in the New York Institute for Deaf Mutes with extraordinary success. Is anything true? If so, please give me some information. A. A common formula for calculating the horse power of a belt is "a single belt will transmit one horse power for each inch of width and for each 1,000 feet velocity per minute." A double belt will transmit 1 8-10 times as much power as a single belt. According to this formula, a 9-inch single belt, traveling over a 6-inch pulley, making 40 revolutions per minute, will transmit 6 2-10 horse power. If it is a double belt, it will transmit 11 2-10 horse power. If you are figuring on an engine or other source of power to drive this machine, it would be well to allow a considerable factor of safety above these amounts, as most machines require at times a power considerably in excess of the average power which they consume. In answer to your request for a small book containing formula similar to the above, we would refer you to the "Handbook of Practical Mechanics," price $1.00. Information as to how to reach the acousticon has been mailed you.

(9209) W. F. H. writes: Please advise me by mail or through Notes and Queries of the SCIENTIFIC AMERICAN the number of pounds of water which must be evaporated to give one boiler horse power, when the temperature of the feed-water is 32 deg. F., and the boiler pressure 70 pounds. Also when the feed-water temperature is 100 deg. F. and the boiler pressure the same as above. A. One boiler horse power equals 30 pounds of water evaporated from a feed-water at 100 deg. F., and at a pressure of 70 pounds. This equals 1110-3 B. T. A. per pound. It will require 68 more heat units to evaporate from a feed-water of 32 deg. F. Therefore one boiler horse power equals an evaporation of 28¼ pounds under these conditions.

NEW BOOKS, ETC.

DETAIL DRAWINGS OF A FOUR-FURNACE SINGLE-END SCOTCH BOILER. Together with Diagrammatic Pipe and Auxiliary Plan used in Connection with a Triple Expansion Engine and a 1,250-Horsepower Triple-Expansion Engine. With Key Naming and Describing Every Part of the Engine. New York: Reprinted from and Published by Marine Engineering, New York. Price $1.

Detailed drawings of standard machinery carefully lettered and provided with a key are among the most useful means of education and reference in marine use. The detailed drawings of a four-furnace single-end Scotch boiler and a 1,250-horsepower triple-expansion engine are reprinted from and published by Marine Engineering and are excellent examples of this class of work. They are well drawn and the lettering is conveniently disposed, a feature which has been too often neglected in this kind of work. For protection the drawings are inclosed in a cardboard cover.

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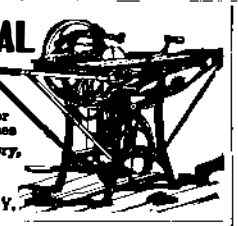

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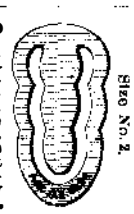

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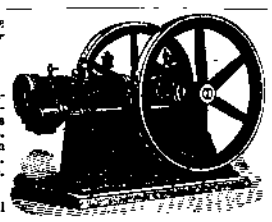

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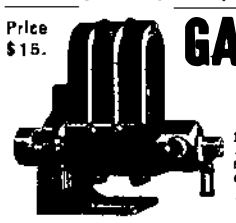

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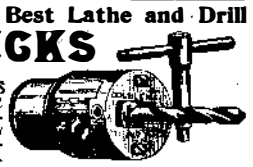

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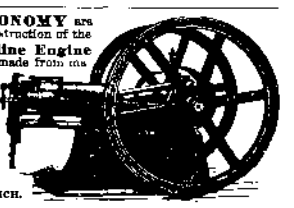

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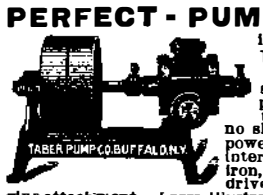

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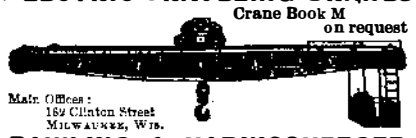

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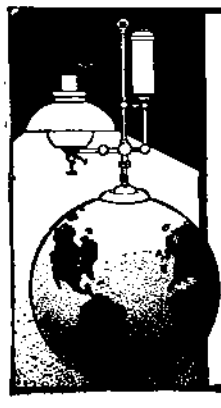

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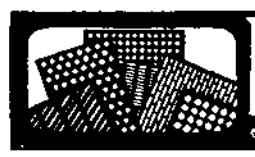

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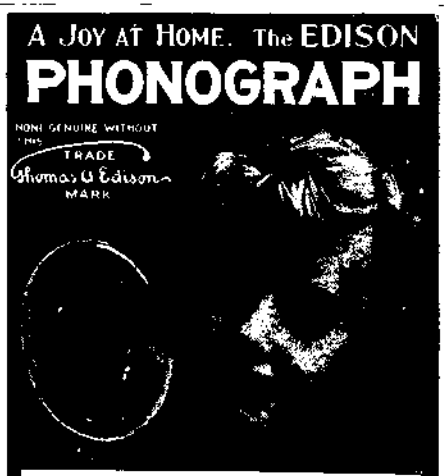

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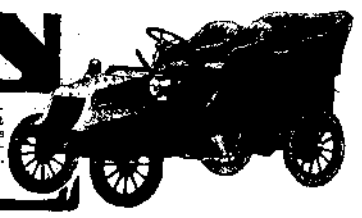

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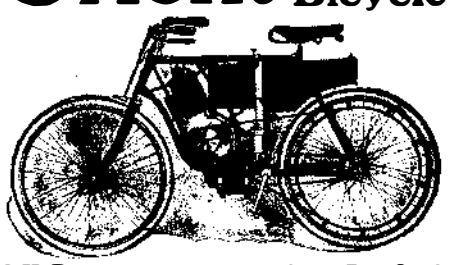

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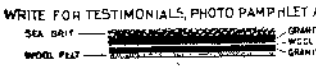

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